Engineering Library

APR 13 1931

# ELECTRICAL WORLD

APRIL 11, 1931

McGraw-Hill Publishing Company, Inc.

25 cents per copy

IRVINGTON INSULATION

## BALANCED INSULATION

In which every necessary quality is present at a maximum value without detriment to any other fundamental requirement.

**Seven Factors of Quality**

High Dielectric Strength  High Insulation Resistance
Flexibility  Heat Resistance  Maximum Elasticity
Non Hygroscopic  Chemically Neutral

Irvington Varnished Cambrics were introduced in 1905 on a basis of greater insulating efficiency. They have consistently held their lead. The base cotton cloths entering into their manufacture are purchased on strict specification. All bleaching and finishing is done in our own plant, before varnishing. Constant and rigid electrical tests guarantee uniformity of electrical characteristics. Write for samples and prices. Our line is complete.

**Irvington Varnish & Insulator Co.**
**Irvington, N. J.**

**Sales Representatives**

Mitchell-Rand Mfg. Co., New York
White Supply Co., St. Louis
E. M. Wolcott, Rochester
Martin Woodward, Seattle
Earl B. Beach, Pittsburgh, Pa.
Electric Insulation Co., Philadelphia
Prehler Bros., Inc., Chicago
Prehler Bros., Inc., Cleveland
Clapp & LaMoree, Los Angeles
A. L. Gillies, Toronto

## And another decision is made favoring outdoor type

# MURRAY LOW LOSS REACTORS

**Relieve the short circuit stresses on your system—even if the equipment is the last word in the electrical art. Murray Low Loss Reactors will support the continuity of your generator output.**

**Dry outdoor type Murray Low Loss Reactors are all cast in concrete, conductor windings are enameled and insulated. Built for operating voltages up to 33KV.**

**METROPOLITAN DEVICE CORPORATION**
**1250 Atlantic Ave., Brooklyn, N. Y.**

# ELECTRICAL WORLD

*A consolidation of Electrical World, Electrical Engineer and American Electrician*

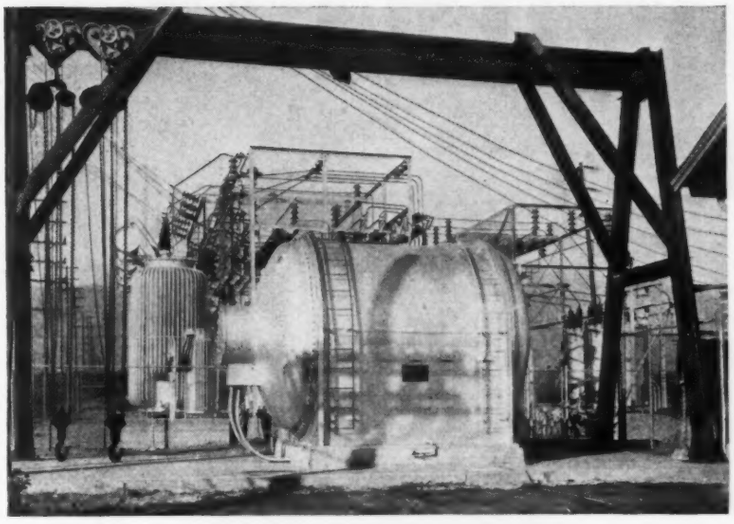


ALLEN M. PERRY
*Managing Editor*
EARL WHITEHORNE
*Contributing Editor*
G. F. WITTIG
*Statistical Editor*
H. M. CAMERON
*Associate Editor*
A. E. KNOWLTON
*Associate Editor*
F. C. WELLS
*News Editor*
E. R. SEARLES
*Assistant Editor*

L. W. W. MORROW, *Editor*

FRANK R. INNES
*Western Editor*
*520 N. Michigan Ave.*
*Chicago*
H. S. KNOWLTON
*New England Editor*
*1427 Statler Bldg.,*
*Boston*
WALTER C. HESTON
*Pacific Coast Editor*
*883 Mission St.*
*San Francisco*
PAUL WOOTON
*Washington*
*Correspondent*
*National Press Bldg.,*
*Washington*

JAMES H. RUDD
*Publishing Director*

*15,000-kva. outdoor hydrogen-cooled condenser Southern California Edison Co.*


## APRIL 11, 1931



Contents Copyrighted, 1931, by McGraw-Hill Publishing Company, Inc.



VOLUME 97 . . . NUMBER 15



News of the Industry ..... 661

Basing Rates on Cost Allocations ..... 672
By ADOLPH KANNEBERG, *Chairman Railroad Commission of Wisconsin*

Electric Heating Insures Quality Production ..... 680

Large Investment Trust Believes in Utility Securities ..... 683
By M. C. RORTY, *American Founders Corporation.*

Industrial Building Design Features Good Lighting ..... 686
By B. W. BERNSTEIN, *Holabird & Root*

Dealers Take Over the Merchandising Job ..... 691
By W. C. HESTON, *Pacific Coast Editor "Electrical World"*

Editorials ..... 669

Flat Type 66-Kv. Switchyard Combines Ten Advantages ..... 676

Studies and Surveys Before Network Installation ..... 677

Glacier Water Heats Swimming Pool ..... 678

New Ratings for Electrical Machinery ..... 679

Making a Difficult Tap on Cable Span ..... 682

British Find Discrepancy in Sphere-Gap Calibration ..... 682

Unit Racks Conserve Space in Meter Storage ..... 685

Rural Electrification Progresses in Illinois ..... 693

Men of the Industry ..... 695

Financial and Statistical ..... 697

Business News ..... 700

New Equipment Available ..... 704



McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. MCGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. MCGRAW, JR., Vice-Pres. and Treas.
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. MCGRAW, Vice-President
H. C. PARMELEE, Editorial Director
C. H. THOMPSON, Secretary

CABLE ADDRESS: *"Machinist, N. Y".*

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

*Member A.B.C.*
*Member A.B.P.*

NUMBER OF COPIES PRINTED THIS ISSUE, 17,850

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
ST. LOUIS, 1556 Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
BOSTON, 1427 Statler Building
GREENVILLE, S. C., 1301 Woodside Building
DETROIT, 2-257 General Motors Building
LOS ANGELES, 632 Chamber of Commerce Bldg.
LONDON, Aldwych House, Aldwych, London, W. C. 2

# OKONITE V.C.

OKONITE Varnished Cambric Insulated Cables are of the same excellent quality that has distinguished OKONITE rubber insulated cables for over half a century. Their dependable performance in every kind of service is a convincing pledge of satisfactory service for the future.

**THE OKONITE COMPANY**

Founded 1878

THE OKONITE-CALLENDER CABLE COMPANY, INC.

Factories: Passaic, N. J. Paterson, N. J.

SALES OFFICES:

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH ST. LOUIS BOSTON
ATLANTA BIRMINGHAM SAN FRANCISCO LOS ANGELES SEATTLE DALLAS

Quality Stores: Philadelphia, Pa. Canadian Representatives: Cuban Representatives:
Engineering Materials, Limited, Montreal Yumuri, Mendoza Co., Havana

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

# ELECTRICAL WORLD

*for the Week Ending*

**April 11, 1931**

## New River minor license refused

—**Power Board is recalcitrant** and refuses Appalachian Electric Power Company a minor-part license for New River project in spite of Attorney-General Mitchell's opinion that one could properly be granted—*p. 662.*

—**Industrial building lighting** won a major consideration in the new Middle West home of the Jewel Tea Company. Here flexibility, wiring adequacy and effective use not only gained attention but a real victory—*p. 686.*

*We don't know one-millionth of one per cent about anything! . . . We are just emerging from the chimpanzee state mentally.*

THOMAS A. EDISON

## St. Lawrence bill at last approved

—**Utility securities rated high** by investment trusts. Executive of one group tells what his bases for judging securities are and finds utilities to measure up well on all of them—*p. 683.*

**Electric heat treating best** is conclusion of chief metallurgist of large aircraft manufacturer. Safety depends upon the quality of metal. In aircraft engines there can be no compromise—*p. 680.*

—**Ontario to cut power export?** Acting chairman of Hydro-electric Commission intimates possibility of discontinuing sale of off-peak Niagara energy to American interests. Debates ensue in Legislature—*p. 665.*

—**Long Beach tries experiment** in merchandising. Southern California Edison withdraws there from major appliance selling and gives dealers and merchants fifteen months to show what they can do toward load building—*p. 691.*

## Arc-welded boilers for navy ships

—**X-rays to test arc welding** of boiler drums for four cruisers. Development of satisfactory nondestructive tests has led Navy Department to approve welded construction. Weight saving of a ton per boiler foreseen—*p. 666.*

—**Costs as a basis for rates** discussed by chairman of Wisconsin Railroad Commission. Frequent loss in returns from small domestic customers confirmed. Analysis justifies rapid tapering of block rates—*p. 672.*

## Copper up after fall to 9½ cents

# Power Commission Refuses Minor-Part License for New River Project

DECISION on the long-pending application of the Appalachian Electric Power Company for a minor-part license to permit it to construct a power plant on the New River near Radford, Va., was reached on April 3, when the Federal Power Commission refused the company's application, offering it instead a standard license. In taking this stand the commission reaffirmed the contention of the former tri-departmental commission, which on June 1, 1927, found that the development of the New River "would affect the interests of interstate and foreign commerce" and should therefore be subject to the full jurisdiction of the commission. A minor-part license, applied for on October 6 last by the company subsequent to its refusal of the standard form, would have exempted the company from the accounting, valuation and recapture provisions of the water-power act.

The decision rendered last week virtually reverses the opinion given by Attorney-General Mitchell last September at the request of President Hoover in which the law officer declared that the New River project was of the character to which minor-part licenses apply. A statement signed by all five members of the new commission in explanation of their stand says:

It is the judgment of a majority of the commission, in view of the conflicting evidence and opinion as to New River being "navigable waters within the definition of the act," that jurisdiction is more properly based upon Section 23 of the act, applicable to streams of this character where the authority of the commission is clearly defined, leaving to the courts the determination of the question of "navigable waters as defined in the act."

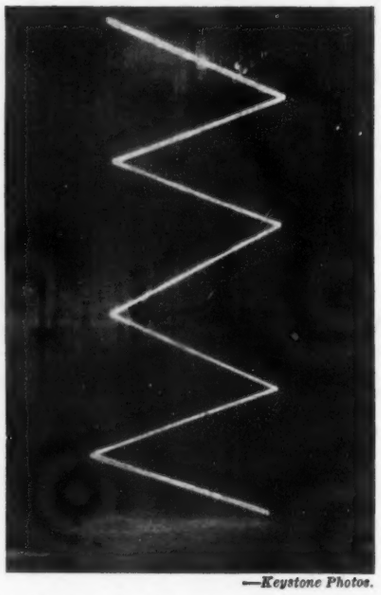
It is the unanimous opinion of the commission that the evidence clearly sustains the finding that the proposed construction would affect the interests of interstate and foreign commerce. New River is the principal tributary of the Kanawha River and as such in low-water periods supplies the principal part of the flow of the Kanawha River, a navigable stream presently used in interstate and foreign commerce, and the Kanawha River is one of the principal tributaries of the Upper Ohio River, a navigable stream presently used in interstate and foreign commerce. These facts, together with others in the record, support such finding.

In its opposition to assumption of complete jurisdiction over New River by the Federal Power Commission the Appalachian Electric Power Company was sustained, on the ground of state rights, by the governments of Virginia, West Virginia, Kentucky, Tennessee and Arkansas—Virginia, as the state containing the site, being especially emphatic in its attitude. If the case finally reaches the federal courts, as seems likely, the state governments will probably play a part.

Had the commission decided the other way, enhanced interest would have attached to the senatorial attempt to force George Otis Smith from the chairmanship of the licensing body. This case is soon to come before the federal courts, with ex-Senator George W. Pepper of Pennsylvania acting as attorney for Mr. Smith, supported as a "friend of the court" by the Attorney-General—who has maintained the validity of President Hoover's refusal to return to the Senate for fresh action that chamber's ratification of Mr. Smith's appointment—and John W. Davis of New York and Alexander J. Groesbeck of Michigan acting for the Senate. The fact that Mr. Smith has in the matter of New River disagreed with the Attorney-General and, in the exercise of impartial and independent judgment, taken a stand undoubtedly dictated by his convictions but none the less certain to please the protesting senators and the declaimers against the "power trust," may possibly cause the agitation over him to take on a somewhat perfunctory aspect. Attorney-General Mitchell, however, has taken issue with statements that he would take only an incidental part in the defense of Dr. Smith and says he will give the case the "thorough attention which its importance deserves," though for technical reasons he will not appear directly as Dr. Smith's counsel.

▼

## ZIGZAG LIGHTNING IN THE LABORATORY



—Keystone Photos.

*Valued at 3,000,000 volts, this artificial flash of lightning is made to run on a 75-ft. thread-like wire from roof to floor of a Westinghouse laboratory in Trafford, Pa.*

▼

## St. Lawrence Bill Passes, Ending Political Fight

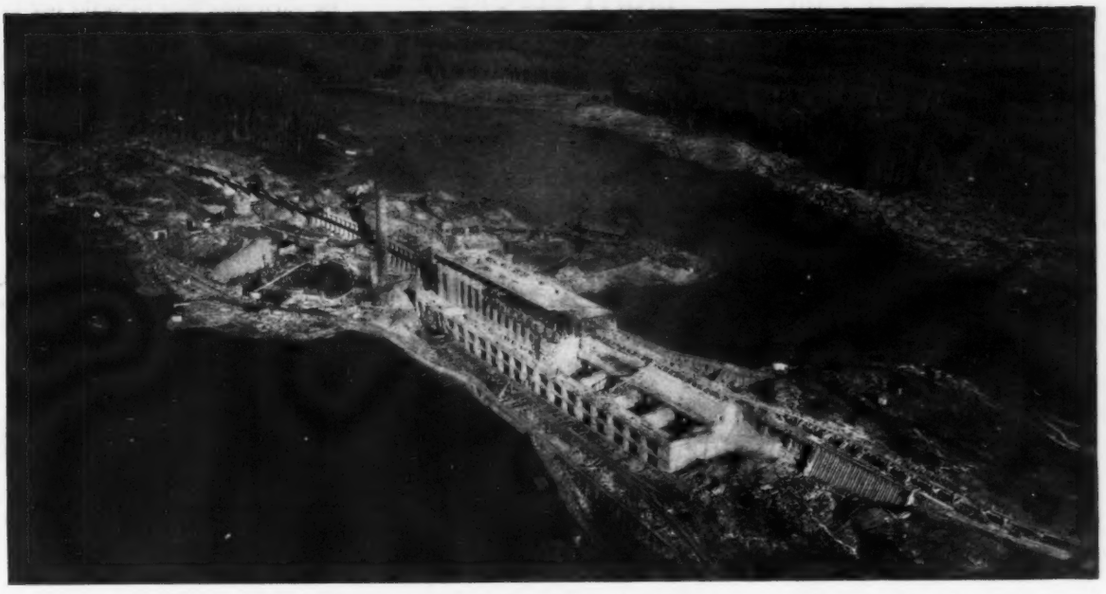
EIGHT years or more of legislative squabbling in New York State over St. Lawrence River development apparently came to an end on Tuesday of this week when the Senate at Albany passed the Cornaire bill in the same form in which the Assembly had passed it, three Republican senators joining with the Democrats to eliminate the Knight amendment, referred to last week, which stipulated that Governor Roosevelt should appoint as trustees of the Power Authority to be set up the five members of his St. Lawrence Power Development Commission.

For a time it looked as if the bill had struck an eleventh-hour snag which would prevent its becoming law, inasmuch as the Governor at once took umbrage at this amendment, declaring it an encroachment on his prerogative. He threatened to veto the bill if the amendment was retained and prepared both to send a special message denouncing it to the Legislature and to broadcast by radio an appeal to voters to demand its excision. Opposition to the amendment by Republican legislators from St. Lawrence River constituencies, fearful of delay in beginning work on the great plant, and a statement from the four majority members of the Power Development Commission that they would not accept appointment unless there was concord between the Governor and the Legislature on the matter led Senator Knight to weaken in his stand, so that the Governor withheld his legislative message and changed somewhat the tenor of his radio talk.

"I shall give no consideration to who should be trustees until after the bill has been signed and becomes law. It is, of course, well to bear in mind the fact that the functions of the power trustees are very different from those of the investigation commission which studied the plans and reported," he said.

Some legal authorities at the Capitol seem inclined to the view that the appointees by the Governor must be confirmed by the Senate. The Power Authority is not considered as a new state department, and one could not be set up without an amendment to the constitution itself.

## WINNIPEG'S NEW HYDRO PLANT PROGRESSING RAPIDLY



*This coming plant at Slave Falls, on the Winnipeg River, 86 miles from Manitoba's chief city, is designed for eight 12,000-hp. units, two of which will compose the initial installation, to be ready for operation this summer. A high-tension transmission line will carry the power to Winnipeg.*

▼ ▼ ▼

### Full Service Resumed in Piedmont Carolinas

As a result of heavy rains throughout the Piedmont Carolinas the Duke Power Company has notified industries holding secondary contracts that they may resume the use of hydro power supplied by it, and it is hoped that further rains will prevent any need to cut them off again because of contract provisions.

Discontinuance of hydro service to these industries was in accordance with the terms of their contracts with the Duke Power Company for conditional supply and did not reflect on the capacity of that company's steam plants, which, if called upon, could take care of the entire deficiency in their territory.

▼

### Seattle Officials Want Puget Sound City Lines

The Seattle City Council has before it an ordinance which its sponsors desire to place before the voters at the March election next year, involving the question of taking over the entire distribution system of the Puget Sound Power & Light Company within the city borders and also the White River and Snoqualmie Falls hydro-electric plants, these being included to avoid severance charges from the company.

Estimates of the cost of such a purchase have been placed at between $50,000,000 and $70,000,000. It is urged by three councilmen as a means of cutting out costly duplication of pole lines and underground conduits as well as double overhead charges. James D. Ross, former city light superintendent, is quoted as approving the plan and saying that with the authority now possessed by the department to do its own engineering, the acquirement should save the city $3,000,000 a year.

▼

### Rochester Utility's Head Makes Rejoinder on Rates

Asserting no understanding on his part that a merger of the Rochester Gas & Electric Corporation and the New York State Electric & Gas Corporation had been made by the parent company of both, the Associated Gas & Electric, a *sine qua non* of rate reductions in Rochester, as asserted by Chairman Maltbie of the New York Public Service Commission in the letter from him to Herman Russell, president of the Rochester company, quoted from last week (page 618), Mr. Russell has issued a statement in which he says:

Any reduction in electric rates which the company has offered at this time comes solely in an effort to save the city and the company the cost of a long rate case which will create bad feeling in the community, disturb the steady progress which this company has been able to make and seriously interfere with the important part which this company has always played and would like to continue to play in the development of this great city and not because any decrease in rates is justified at this time on the basis of earnings either past or present. This company is suffering severely along with other industries because of the business depression and reductions at this time are not justified except for the reasons given above. . . . I am still in hopes that a satisfactory adjustment may be arrived at both as to finances and the rate matter.

Rochester and Monroe County officials are reported to be strongly opposed to the merger.

▼

### Power and Regulation in State Legislatures

Illinois and Texas have to be added to the number of states in which measures to prohibit the utility companies from merchandising have been introduced. Missouri and Nebraska will probably be numbered with the states in which such bills have failed, the defeat of the House bill in the Missouri Senate's judiciary committee and the indefinite postponement of the Nebraska Hardware Dealers' Association bill by the Nebraska House, as previously reported, in all probability meaning the abandonment of such measures in the present sessions.

ALABAMA.—A favorable report on a bill to prevent public utilities from assessing a penalty on overdue bills or from levying a service charge for installing equipment disconnected for nonpayment has been made by the Senate judiciary committee.

ARKANSAS.—All public utility franchises in Arkansas will remain in

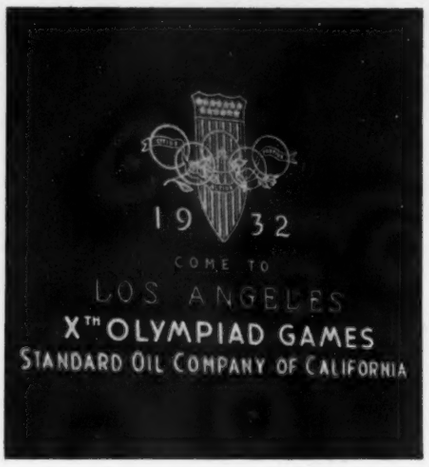
force and the machinery of utility control will remain unchanged as a result of Governor Parnell's veto of a bill passed by the Legislature which would have given jurisdiction to the State Railroad Commission over utilities everywhere in the state, except that rate charges and regulations of utilities in cities of the first and second class would have remained in the cities as at present. The vetoed bill re-enacted the law of 1919, which was repealed in 1921, under which all utilities could surrender franchises and take indeterminate permits.

ILLINOIS.—A House bill provides that no public utility or any of its subsidiaries shall after September 1, 1931, merchandise any electrical equipment or other wares or sell at retail any product of its own or its subsidiaries' manufacture. Another House bill would abolish the Illinois Commerce Commission. Senator Gunning has introduced in the Upper House five bills affecting utilities. One provides that the word "corporation" in the public utilities act shall include municipal corporations; a second decrees that no municipality shall be deprived of the right to grant franchises or licenses to public utilities because of the absence of a state certificate and that franchise holders and regulatory bodies shall not place any value on franchises for rate-making purposes; a third takes jurisdiction over utilities from the commission and vests it in the municipalities; a fourth makes provision for setting up municipal public utility districts not subject to commission control, and the fifth requires the commission to publish a comparative statement of public utility rates.

IOWA.—The House has rejected a bill to create a public utilities commission with regulatory power over all classes of utilities. The vote was 67 to 34. Such a commission was advocated by Governor Turner. It was objected that the bill would deprive the present Railroad Commission, which has jurisdiction over utilities, of its powers and tend to make utility supervision a political question. The proponent of the bill charged that its defeat was due to the activities of a lobby. Governor Turner has signed the Knudson bill to place securities issued by public utility companies under the supervision of the state securities department.

MAINE.—An unfavorable committee report on a bill to levy an excise tax of 4 per cent on the gross revenue of public utilities was accepted by the House last week. An effort to adopt a substitute report was defeated by 74 to 46. The legislative session ended on April 3. A measure to facilitate rural electric service was passed. One to require the Public Utilities Commission to approve contracts between utilities and holding companies was defeated.

## FUTURE EVENTS CAST LIGHT BEFORE




*For the next eighteen months this five-color neon sign at Los Angeles, operated by a photo-electric cell, will flash its invitation. It is 66 ft. high by 75 ft. wide.*

▼

MISSOURI.—The House has passed and sent to the Senate two bills requiring annual reports as to the stockholders of all public utilities under the jurisdiction of the Public Service Commission and on the ownership of all stock in other corporations holding stocks of Missouri utilities. The commission is also authorized to inquire into all transactions between utilities and holding corporations and other affiliated companies. The Senate judiciary committee has reported unfavorably the House bill to prevent utilities from selling merchandise. The bill passed the House 87 to 21. An effort is still being made to get the measure on the Senate calendar.

NEBRASKA.—The bill permitting irrigation districts to acquire, extend and operate electric light and power plants and systems has passed the House and gone to the Governor, who is expected to sign it. The measure in its final form permits irrigation districts to extend their lines beyond their own boundaries. A 20 per cent petition of voters within the district is necessary to call an election, and if the state Department of Public Works finds the plan feasible, a 60 per cent affirmative vote of electors will put the district into business. The district may sell energy to power companies as well as individual consumers, may issue bonds for the erection of plants and lines and may pledge future earnings for plant improvement or extension. The Senate has passed and the House has advanced to third reading a bill substituted for the law which was held invalid by the courts authorizing the incorporation of hydro-electric power districts of one or more urban and rural districts or a combination of both. Bond issues may be voted by each unit and by a 60 per cent vote in the district. This bill, too, permits pledging of future earnings for additions and betterments and allows the district to function outside its boundaries.

OKLAHOMA.—The amendment to exempt certain public utilities from the "blue sky" law governing issuance of securities has been stricken out. A bill passed by the House would enable county attorneys without the consent of the Attorney-General to bring actions against public utility companies for violation of law but would make consent of the Governor necessary to dismissal of such actions. The bill to require light and power companies to make uniform electric rates where more than one town is served and the bill to enable municipalities to issue revenue bonds to pay for plants out of earnings have been advanced to third reading in the House.

SOUTH CAROLINA.—The House has killed the bill to levy an excise tax of 0.3 mill on hydro-electric power generated within the state. It had previously voted down a measure to impose a tax of 0.5 mill.

TENNESSEE.—The State Railroad and Public Utilities Commission has told the legislative investigating commission that it will welcome an investigation as proposed by a resolution introduced in the House before the recess and referred to committee. The commission defends itself against accusations of permitting unfair rates and of failing to protect investors in merger transactions.

TEXAS.—Prospects for the enactment of any bill to set up a public utility commission at this session of the Legislature are remote. The House committee on state affairs has reported adversely on the Petsch bill, previously described, which had the support of Governor Sterling, though a minority report will be made. The Senate committee on state affairs reported favorably the Holbrook bill after an amendment had been adopted exempting gas and telephone companies from obtaining certificates. The Holbrook bill allows municipalities no power in rate-making, while the Petsch bill allowed them limited control of utilities. No date has been set for considering either bill in the Senate or the House. A House bill forbids any utility from selling or distributing goods, wares and merchandise used in the consumption of gas or electricity. The same bill forbids any utility from entering a town without a permit or franchise. The penalty for violating the proposed law is forfeiture of the company's charter.

VERMONT.—The House has passed a revenue measure including a tax of 0.5 mill on all energy generated.

## Utilities Figure Much in Wisconsin Politics

WISCONSIN POLITICS, true to form, is much concerned in this legislative session with matters affecting the public utilities. Concurrence of the Senate on April 2 in the Carow resolution (previously passed in 1929) makes it certain that the electorate will next year decide by referendum whether the state constitution shall be changed to permit municipalities to contract debts in excess of 5 per cent of their assessed valuation for the purpose of acquiring utility plants.

With the adoption of the Carow resolution, only one of the four measures constituting the adminstration's power program remains to be acted upon. Both the Assembly and Senate have already passed a bill permitting the creation of power districts (the House for a second time, 74 to 8) and a resolution for a constitutional amendment to permit the state to enter the public utility business. The bill to permit municipalities to build and operate power plants in competition with privately owned utilities is still before the Legislature, but the Assembly on March 31 engrossed it. This measure authorizes cities to go into the power business without obtaining from the Railroad Commission the certificates of convenience and necessity which have been required by the utility law ever since its enactment under the administration of the elder LaFollette. An amendment adopted fixes the number of years for which a municipality may contract for service with a privately owned utility at five instead of ten.

Senator Loomis will sponsor a fifth step in the program. His state utility corporation bill is intended to encourage municipal ownership, to offer engineering and other expert services to publicly owned enterprises, to obtain agreements from private utilities whereby they will agree to a rate base over a certain period of time to avoid litigation, to appraise all utilities in the state with the objects of better control and ultimate purchase by the state, and actually to take over some utility properties, recapture water powers and produce power at its source as a state undertaking if constitutional authority is granted by a referendum vote in 1934 on the amendment permitting the state to engage in the public utility business.

By the Malchow bill, introduced in the Assembly March 26 and referred to the judiciary committee, the entire system of rate regulation of public utilities would be changed and steps taken to give the new Progressive-controlled Railroad Commission a method of forcing evaluation of utility properties.

The Groves tax bill, which seeks to tax utilities on a regional rather than the state average basis, was denounced before the Assembly judiciary committee by John B. Chapple, editor of the Ashland *Daily Press,* who had been ejected from the Assembly chamber by the Speaker, as discriminatory and likely to force utilities out of northern Wisconsin.

William J. Hagenah, vice-president Byllesby Engineering & Management Corporation, is under arraignment in the Dane County Superior Court charged with violation of the Wisconsin lobby law. The company named and the Northern States Power Company of Wisconsin, a Byllesby organization, are charged with employing two former Assemblymen as lobbyists without registering them. The companies have 20 days in which to answer.

▼

## Ontario May Discontinue Niagara Energy Export

ANNOUNCEMENT BY J. R. Cooke, acting chairman of the Ontario Hydro-Electric Power Commission, that that system makes more than $1,000,000 out of the export of off-peak power to the United States and a further denunciatory attack on the Hydro administration by Dr. G. A. McQuibban were the features of another debate on Hydro matters last week in the Ontario Legislature. W. E. N. Sinclair, the Liberal leader, said he had expected a complete reply to Dr. McQuibban's charges, but instead found them virtually confirmed.

Mr. Cooke remarked that if any one had the courage to demand that the export of power be stopped, it could be discontinued inside of 24 hours. He said that the commission was faced with a choice of buying power in Quebec or importing coal from the United States to make power by steam. He later announced that the commission had decided on the rehabilitation of the system of the Dominion Power & Transmission Company of Hamilton in a way that would allow utilization of most of the off-peak power now exported to the United States. The work, he said, would take a matter of two or three years to complete. The Dominion system is now developing and distributing 61,000 hp., but the commission has decided that it is better adapted to "peak-load" conditions. By rehabilitating it and coordinating it with the off-peak power now exported, the system could distribute 200,000 hp., Mr. Cooke asserted.

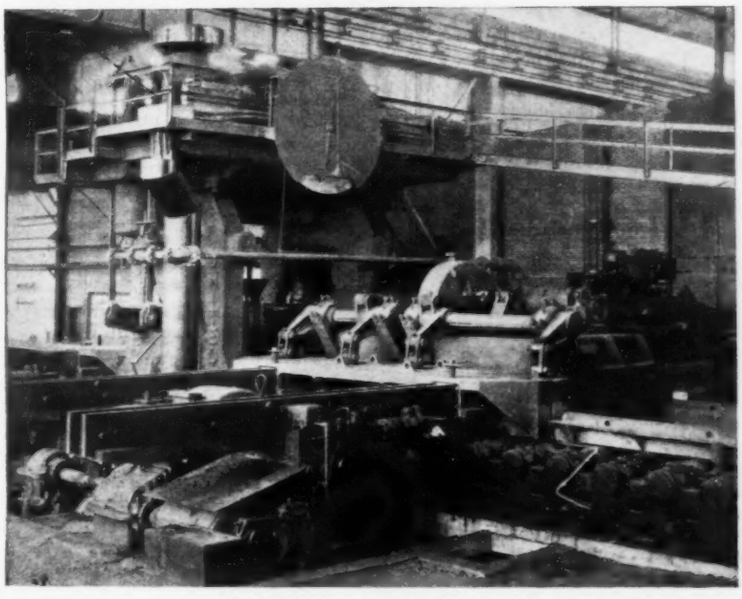
▼

## Southeastern Meeting at St. Petersburg, Fla.

EMPHASIS UPON SECTIONAL MEETINGS characterized the three-day convention of the Southeastern Division, N.E.L.A., held at St. Petersburg, Fla., on April 1 to 3, practical help rather than oratory being the object both of the parallel ses-

▼ ▼ ▼

### GULF STATES STEEL COMPANY'S NEW DRIVE



*A Westinghouse 7,000-hp. reversing blooming-mill motor which consumes 19,500,000 kw.-hr. in rolling 650,000 tons of steel a year from 6,000-lb. to 15,000-lb. ingots is a new piece of equipment at Alabama City (Ala.) steel works.*

sions of commercial men, accountants, engineers and public relations men and of the committee meetings which together filled the afternoons. Prominent speakers were, however, heard, including B. F. Weadock, utility counsel.

At the general sessions Dr. S. J. Thomas, formerly of the University of Alabama, spoke on the utilities' place in the economic world; Miss Sophia Malicki of the Middle West Utilities Company on the part played by women employees in bettering public relations, and Harry Reid, chairman Public Relations National Section, on public relations and how to improve them. Managing Director Paul S. Clapp from N.E.L.A. headquarters also spoke.

An innovation in methods of recognition of association work was initiated through the presentation of meritorious service awards by the association to committee chairmen.

New officers elected are: President, Jo C. Guild, Jr., Tennessee Electric Power Company, Chattanooga; first vice-president, L. A. Magraw, South Carolina Power Company, Charleston, S. C.; second vice-president, J. W. Hancock, Appalachian Electric Power Company, Roanoke, Va.; third vice-president, J. M. Barry, Alabama Power Company, Birmingham, Ala.

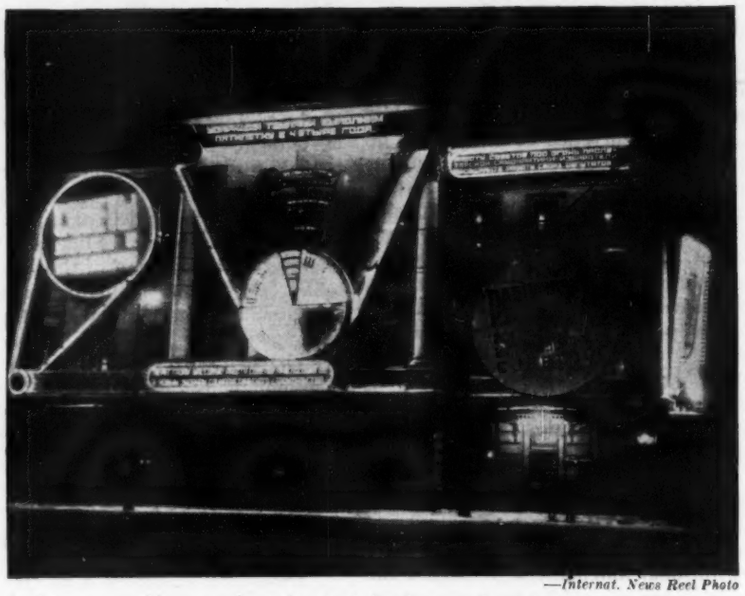
▼

## Raskob Is for State Control of Utilities

CHAIRMAN JOHN J. RASKOB of the Democratic National Committee, in the course of a letter to the members of that body in which he makes recommendations for the party's platform in 1932, gives evidence that his influence will be against any advocacy of federal control of public utilities. He says:

> Complaint is made that by means of overcapitalized holding companies small utility units are merged into huge organizations and then excessively high rates are charged the public in order to pay dividends on these watered securities issued by the superorganization. Some ask for federal curbs on these giants, which is another of the regrettable tendencies to extend the powers of the central government.
>
> My idea is that the states should themselves exercise this police control; that the states should say to the local light and power plant: "We are not concerned with what securities your controlling corporations may issue. You are permitted to make your rates proportionate to your investment and production costs, and to that principle we will hold you. It is no part of the burden of the people of this state to pay dividends on securities issued by any supercompanies even if you have surrendered control of your business to them, except in so far as fair rates to our people provide earnings on your real investment." That, it seems to me, would be adhering to the strict Jeffersonian principle of state rights and state prerogatives and would be a definite curb on possible rapacity.

## ILLUMINATING MOSCOW'S FIVE-YEAR PLAN



—*Internat. News Reel Photo*

*In bizarre outlines against the dark background of the House of Unions in the Russian capital the government traces in electric light the progress of its famous "five-year plan."*

▼ ▼ ▼

## California Public-Plant Men Finish Organization

AMONG THE MEMBERS of the newly formed Publicly Owned Gas and Electric Utility Association of California are the Los Angeles Bureau of Power and Light, the Modesto Irrigation District, the Burbank Public Service Department, the Glendale Light and Water Department and the light and water departments of the cities of Pasadena, Riverside, Alameda, Palo Alto, Lompoc, Redding and Roseville, besides smaller bodies directing public utilities. Such members are known as corporate members. Active membership is composed of executives, board members, employees or other individuals actively employed in the management, operation or business of publicly distributing electrical energy or gas on behalf of any of the corporate members. Among the objects of the association, as set forth in its constitution, in addition to "the advancement of fundamental and practical knowledge," is "to provide ways and means of promoting favorable legislation and to combat unfavorable legislation." Mutual assistance is pledged.

Four officers and five directors constitute the governing board of the association. The recently elected officers are: President, B. W. Creim, electrical engineer Modesto Irrigation District; first vice-president, Peter Diederich, superintendent plant and production, Glendale; second vice-president, F. R. Chilton, city clerk, Roseville; secretary-treasurer, J. H. McCambridge, general superintendent Public Service Department, Burbank.

▼

## Navy to Arc-Weld Drums of Boilers on Four Ships

SATISFIED THAT METHODS are available by which it is practicable to make inspection tests of welds, the Bureau of Engineering of the Navy Department has decided to use electric welding on the main boiler drums of four of the 10,000-ton cruisers now under construction. Previously naval officers have hesitated to make extensive use of electric welding because of the difficulty in making non-destructive tests of the completed weld. Now, however, it is believed that, by making X-ray plates of each inch of the weld and by magnetic analysis, it will be possible to make a satisfactory test without damaging the work. The first electric welding to be undertaken by the Navy Department was for the superheater drums for the light cruiser *Portland*. The *Portland* will be completed in 1932.

The contract for the largest electric welding job yet approved—that for the 32 main boiler drums referred to above—has been let to the Babcock & Wilcox Company of New York. The cruisers are to be completed in 1933. The drums will be approximately 48 in. in diameter. It is estimated that a saving in weight of nearly a ton per boiler will be effected as compared with riveted drums.

## Scattered Happenings in the Electrical Sphere

### United States

TWO POWER COMPANIES and seven canal and irrigation companies in California have been named as defendants in a suit filed in the Superior Court at Modesto, Calif., by 41 ranchers of western Stanislaus County, who seek a total of $2,522,-814 for alleged damages to their properties through the appropriation of water from the San Joaquin River. The power companies sued are the Southern California Edison and the San Joaquin Light & Power.

ERECTION OF A STEAM power plant on the shores of Utah Lake, just south of Salt Lake City, at an estimated cost of about $5,000,000, is under consideration by the Utah Power & Light Company, provided that the Utah Legislature will allow it to acquire rights to state-owned lands under the surface of the lake to enable it to build a long flume.

A REQUEST THAT the Public Utilities Commission of the District of Columbia delay any action to force lower rates on the Potomac Electric Power Company until the trend of business for this year shows its effect (unfavorable in January and February) upon net profits is the company's response to the commission's proposal of amicable court adjustment. (ELECTRICAL WORLD, March 28, page 570.)

PLANS FOR THE MADDEN DAM to be built by the federal government in the Panama Canal Zone include a hydro-electric plant—the substructure of which will be monolithic with the concrete of the dam. It will contain three units of about 8,000 kw. rating each.

A RULING HAS BEEN MADE by the Federal Power Commission that the application of the Arkansas-Missouri Power Company to build two low dams on Spring River in Arkansas does not fall within its jurisdiction, as the stream is non-navigable and the interests of interstate commerce are not affected.

PURCHASE IS REPORTED of the Electric Utilities of the White Mountains, with assets of about $2,000,000, by the International Public Utilities Company, subsidiary of the International Utilities Corporation of New York. The purchased properties comprise five small New Hampshire companies with headquarters at Meredith, N. H.

FROM MAY 5 TO 15 inclusive the annual industrial electric heating school of the N.E.L.A., assisted by the N.E.M.A., will be held at Detroit. Speakers will include leading authorities from the public utility and manufacturing branches of the industry. J. L. Faden, Boston Edison Company, is the N.E.L.A. committee chairman.

PLANS FOR A HYDRO-ELECTRIC plant on the Saco River near Biddeford, Me., to cost about $300,000, are being worked out by the Cumberland County Power & Light Company, Portland.

REPRODUCTION OF THE PROPERTIES of the Galveston Electric Company, including the electric light and power plant and street-railway system, could be accomplished by the city of Galveston at a cost of $4,870,513, and the municipal holdings could be operated at a saving to consumers of $160,000 annually as compared with the total charges paid by them under private ownership, according to a report made to the City Commission by Burns & McDonnell, engineers of Kansas City.

SIXTY OUT OF 200 separate reports to be made by the War Department to Congress on the water resources of the principal rivers of the United States have been submitted; more than 30 additional reports are in various stages of completion, and it is hoped to finish these and prepare the remaining ones by the end of this year.

▼

## Coming Meetings

**Northwest Electric Light and Power Association**—Accounting Section, Salt Lake City, April 13 and 14; general convention, Boise, Idaho, June 17-20. B. Snow, 1208 Spalding Bldg., Portland, Ore.

**Missouri Association of Public Utilities**—Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

**Southwestern Division, N.E.L.A.**—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

**Electrochemical Society** — Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.

**American Welding Society**—New York, April 22-24. M. M. Kelly, 29 West 39th St., New York.

**American Institute of Electrical Engineers**—District meeting, Rochester, April 29-May 2. F. L. Hutchinson, 33 W. 39th St., New York.

**East Central Division, N.E.L.A.** — Deshler-Wallick Hotel, Columbus, Ohio. May 11-13. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

**National Electrical Manufacturers' Association** — Hot Springs, Va., May 18-23. A. W. Berresford, 420 Lexington Ave., New York.

**Middle West Division and Nebraska Division, N.E.L.A.**—Excelsior Springs, Mo., May 20-22. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

**National Electrical Credit Association**—Hotel Pennsylvania, New York, May 21 and 22. F. P. Vose, 1008 Marquette Bldg., Chicago.

**National Electrical Wholesalers' Association**—Hot Springs, Va., May 27-30. E. Donald Tolles, 165 Broadway, New York.

**Wisconsin Utilities Association** — Accounting Section, Racine, May 28-29. J. N. Cadby, 135 W. Wells St., Milwaukee.

**National Electric Light Association**—Atlantic City, June 8-12. A. J. Marshall, 420 Lexington Ave., New York.

**Public Utilities Advertising Association**—New York, June 14-16. Room 1748, 4 Irving Place, New York.

**Association of Iron and Steel Electrical Engineers**—Cleveland, June 15-19. J. F. Kelly, Empire Bldg., Pittsburgh.

FIRST ACTION OF THE newly appointed single Public Utilities Commissioner of Oregon has been to order an investigation of the rates and service of the Mountain States Power Company of Albany and the California-Oregon Power Company of Medford.

NEW ELECTRIC RATES just in force will result in savings exceeding $100,000 annually to customers in Charleston, S. C., and suburban sections. All lighting customers of the South Carolina Power Company will have the choice of paying 9 cents a kilowatt-hour for the first 100 kw.-hr. (a reduction from 10 cents) or going on a contract rate which would bring a smaller total for consumption of 40 kw.-hr. or more.

EXECUTION OF CONTRACT between the city of Portland and the engineering firm of Carey & Harlan for an investigation as to the feasibility of municipal power development for the city was completed recently. The Council had appropriated $25,000 for this investigation. The contract sets forth seven specific provisions to be fulfilled by the report of the engineering firm, including a study of possible power production at Umatilla Rapids and other sites on the Columbia River and at various sites on the Deschutes.

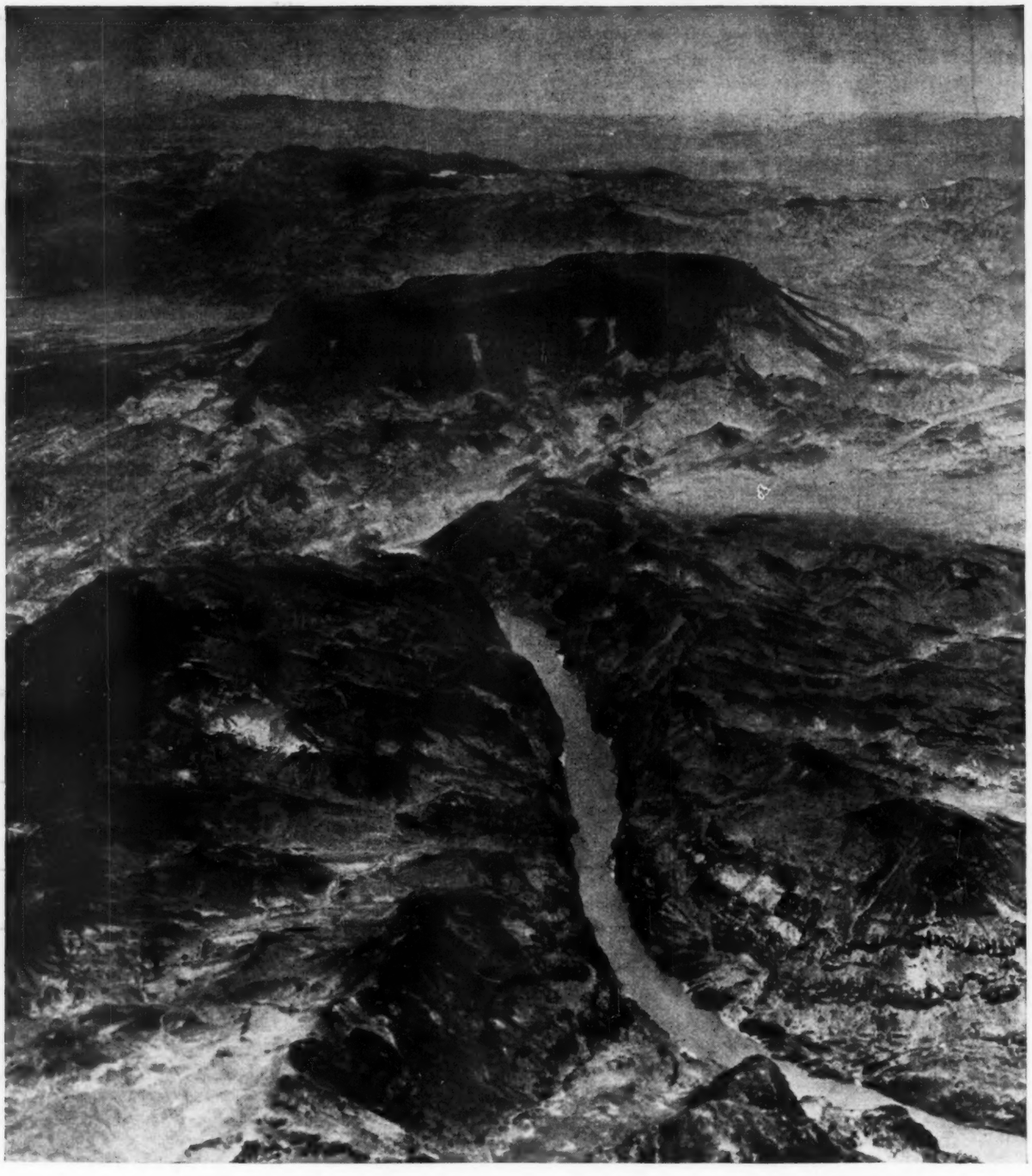
A CAMPAIGN FOR lower electric, gas and telephone rates and street-car fares in Milwaukee has been begun by Mayor Daniel Hoan, Socialist. In a letter sent to the Common Council the Mayor suggests that the Council direct the city attorney to start immediate proceedings before the Railroad Commission.

APPLICATIONS OF ARC WELDING to boilers and machinery foundations for the navy and to structural steel work, its use with copper alloys and alloy steels, resistance welding problems and other topics of interest to electric welders will be the subjects of papers at the annual meeting of the American Welding Society in New York on April 22-24.

A RESOLUTION AUTHORIZING the Board of Public Affairs of Little Rock to execute a five-year contract with the Arkansas Power & Light Company for purchase of all electrical energy used by the city at a rate of 1.25 cents a kilowatt-hour has been adopted by the City Council, though its legality is called into question.

### Canada

RECENT FIGURES show that investments by the government and the four most active companies engaged in production and distribution of electricity in the Province of Saskatchewan aggregate approximately $19,225,750, of which $3,866,347 is credited to Canadian Utilities, round figures of $3,000,000 to the Dominion Electric Company, $2,000,-000 to the Montreal Engineering Company and $2,875,000 to the National Light & Power Company.



## Where Hoover Dam will rise 730 ft.

Here in a sun-tortured, rocky waste of the Southwest one of the largest engineering projects in the United States is now under way at a contract price for power plant and appurtenances of about $49,000,000. The plan is to bring power and water to peopled lands and regulate for flood control of the Colorado.

Magnificent feat or unprecedented folly—who knows? Estimates of ultimate costs rise by millions at frequent intervals. Congress has voted $165,000,000 for the complete power-irrigation development.

# EDITORIALS

L.W.W.MORROW
*Editor*

## Opportunities for power sales

SOME utilities are adopting broader policies for power sales as a result of present conditions. The easily sold power loads are served, but there remain many process-steam industries and large industrial firms that have private plants. Small isolated power sources have become cheaper to buy and to operate, and local competition is keener. The business depression has caused many private industrial establishments to operate their power stations at very low economic efficiency.

All these things are being capitalized upon by some utility managements that take a broad position in regard to power sales and power generation. The first principle they apply is that utilities can make and supply power to better advantage than any industrial or local enterprise and that this is the reason they are in the power business. The second principle is that the answer to any local power problem dictated by economic and service considerations is the one to be used to obtain the business. This answer may be purchased power from the utility system, the use of an isolated generating station or the use of a local station interconnected to the utility system — it depends upon specific local conditions.

But if local generation is the economic answer to an individual power problem, it should be the policy of the utility to take advantage of the situation, apply the economic answer and do the power business. This may involve the ownership or lease and operation of an existing isolated station in a process-steam industry or in a large industrial plant. It may involve the ownership and operation of small isolated generating plants in small towns. It may involve taking over and modernizing a local industrial station by the use of high-pressure boilers or mercury turbines. It may involve the interconnection of local owned or leased plants with the large stations of the utility system. There is no general answer to local power sales opportunities, but the trend in equipment and economics points toward a very broad and flexible policy.

It is not the universal answer to say that power should be purchased from the system that exists. There should be no inhibitions against the adoption of a program that involves ownership, lease and operation of small-capacity isolated power stations in conjunction with the large-system stations if this is economical. A very large increase in power business is available through the use of broader policies and more expert salesmanship, and it is encouraging to note that some utilities are measuring up to the power-sales opportunities.

## More hydro handicaps

DECISION of the Federal Power Commission in the New River case shows that it is not in favor of the minor-part license interpretation of the federal water-power act. This decision was based upon the broad provision that the proposed development would affect interstate commerce and not upon the contention that New River is a navigable stream.

Economic advantages in favor of hydro developments as compared with fuel-burning stations are steadily decreasing, and added governmental and state restrictions upon water-power grants are likely to be decisive in restricting further investments. This is true especially in the New River regions, where ample coal may be had at a reasonable cost and where stream-flow variation is excessive. Thus the policy of the Federal Power Commission may well please the senatorial radicals and at the same time restrict the actual use of water-power resources.

## Can dealers do the load-building job?

TRADE relations form one of the major matters before the industry today. The problem has many ramifications. Several meritorious plans are being tried, but one in particular is attracting nation-wide attention at this time. It is the so-called Long Beach experiment in California. Here the power company withdrew from major appliance selling last fall to give dealers a free hand for fifteen months.

Thus far the dealers have not been exceptionally successful. They were handicapped at the start by poor business conditions and a lack of widespread public acceptance of electric cooking, but they are optimistic and feel confident they alone can do the central-station load-building job. This remains to be seen.

Three things already stand out as a result of the experiment: First, the dealers feel that the discount on electric ranges must be increased and the range placed on a sound merchandising basis if it is to be successfully promoted and sold through retail channels; second, they believe that manufacturers must give dealers the same degree of co-operation in sales promotion as they gave the power company; third, some workable plan of sales supervision must be set up to co-ordinate the efforts of dealers. Steps have already been taken to overcome these obstacles. There is believed to be a movement under way to correct the discount situation; one large manufacturer has stepped into the breach with sales co-operation, and a supervisor working under the direction of the Electragists has been employed to direct promotional activities.

If conclusions were to be drawn at this time, they would be these: Dealers are confident they alone can accomplish the task; the Electragists, the jobbers and distributors, the manufacturers and the power company feel that the power company will have to lend its material assistance if a satisfactory load is to be built; manufacturers and distributors of water heaters and heavy-duty air heaters feel that they are out of the picture unless the power company will actively promote and sell these devices.

At least, it may be said that all those concerned have entered into the Long Beach experiment in the fullest spirit of co-operation, and it is to be hoped that the ultimate outcome will aid in pointing the way to a solution of this important industry question.

## Aiding graduate study a timely duty of industry

THE outlook for employment of engineering graduates this year is not at the moment rosy. There is in this situation, however, a redeeming feature that incidentally has its bearing on the future stabilizing of business generally and which also possesses potentiality for correcting an adverse trend in educational circles during the last decade.

In the lively business period which rose to a climax in 1929 engineering educators were deploring the depletion of the teaching ranks because more attractive and lucrative opportunities were offered by industry than could be met competitively by educational institutions. The picture for the moment has been reversed, and now is a propitious time for technical schools to lay the foundations for a re-energized teaching personnel. Those superior students with the attributes requisite for effective and personable pedagogy can be more advantageously selected and enticed into the profession than at any time since before the war. An enlarged degree of aid to the prosecution of graduate study should be offered by the schools wherever funds, facilities and teaching staffs permit. Out of this group of advanced students will come some of the teachers of the next decade.

The electrical industry has here a commensurate opportunity to alleviate the educational situation in two ways. One is by aiding the engagement of students with limited opportunity for employment by encouraging them to continue their education in advanced engineering or in fields correlated with engineering. The other is by making available both superior teaching staffs and superior technical man-power when business decides to resume its stride and again demands plenty of the best of technical talent in its recruits. Such encouragement need not tax the

shrunken coffers of industrial concerns. Unsolved problems of research can be passed to the schools for prosecution. Idle facilities and equipment can be loaned or made available to them for experimental or survey purposes. Departmental executives and experts not now crowded to the limit can safely be authorized to correlate these researches with the future activities of the industries.

The cry for more high-grade technical men and for more high-grade technical teachers can be answered in a single move, thus assuring industry of its technological security and stability after the public temper has decided that this perplexing depression has run quite long enough.

## New light relay has control possibilities

DIRECT conversion of solar energy to electrical energy may be found to have advanced several stages nearer realization if and when a new light-sensitive cell just announced proves its practicability. Dr. Bruno Lange of the Kaiser Wilhelm Institute announces a cell resembling in structure the familiar copper-oxide cell used for rectification but relying on the surpassing properties of silver selenide. The latter coating is a cathodically sputtered deposit only a few molecules deep on a layer of other metal. A square yard of the surface exposed to full sunlight is said to produce several watts. The estimate of present cost per kilowatt of capacity is $25,000. It would take a square mile to house the cells needed to equal the capacity of a 300,000-kilowatt station. Evidently there is some distance to go before such a scheme of power generation will constitute an economic threat to prevailing combustion and hydro methods. Its possibility does, however, give solace to those who worry about the exhaustion of fuel resources.

The real immediate field of usefulness for the new development lies in the realm of sound-picture, television and industrial-control applications of light-sensitive relays now founded on the properties of potassium, caesium and selenium. There are a host of industrial uses for a sun relay that will elevate the obtainable current magnitudes out of the region of minute currents and shift the decimal point two or three places to the right. The associated devices will simultaneously abandon the delicacy which now deters their use in some applications, and the control devices will acquire that ruggedness which will enhance their appeal in places where the mind is accustomed to think in gross magnitudes.

## Taxation pressure increasing

IN SEVERAL states the burden of taxes has become oppressive. State and municipal property values exempt from taxation are becoming increasingly large in proportion to total taxable property. The cost of national, state and local government and of schools, good roads and other improvements has gone up steadily. In some states total taxation is now from 7 to 10 per cent, and this pressure is causing people to squirm—especially in a year of business depression.

The farmers try to shift the burden to business, gasoline taxes are at a peak, state income taxes are mounting, special excise and sales taxes are proposed, and attempts are made to increase utility taxation, which already is at a high value. Idaho is the latest state to assess energy generated, that commonwealth having imposed a tax of 0.5 mill per kilowatt-hour. Much of the energy generated in Idaho is water power and a large proportion is exported to Utah, so that in both these states industrial development and increased home convenience will now be handicapped.

Taxation of electrical energy is not in the public interest. Electricity is not a luxury, but, on the contrary, establishes the standards of industrial progress and household living conditions. Those states that turn to kilowatt-hour electrical taxation will find that subsidy rather than taxation would be a better path to progress. Subsidy is the basic plea of agitators for municipal and state ownership.

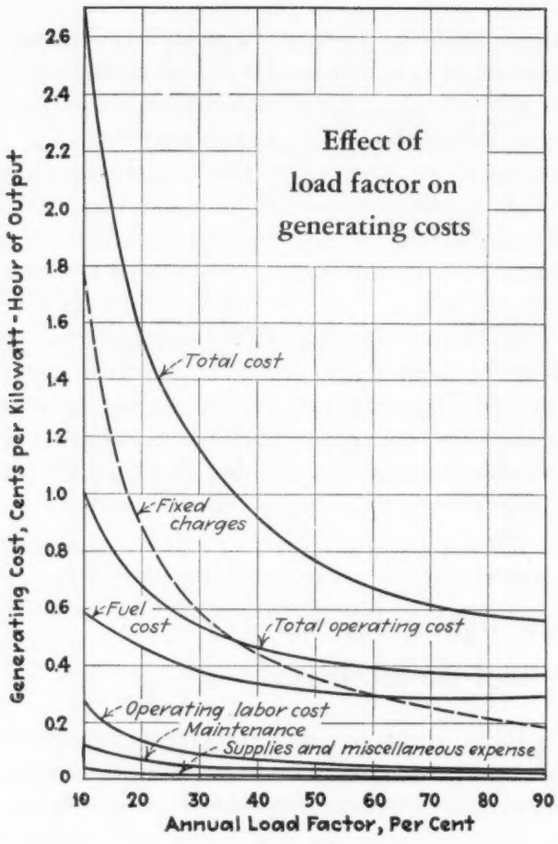
Private enterprise desires no subsidy, but it stands squarely for unhandicapped development of its territories under the stimulus of ample electricity at reasonable cost. This has been the key idea of utility public service. Taxation of electrical energy is merely expediency, not statesmanship.

# Basing Rates on Cost Allocations*

By ADOLPH KANNEBERG
*Chairman Railroad Commission of Wisconsin*

**Frequent loss in serving the small domestic customer confirmed.**

**Rapid tapering of block rates justified by analysis.**




WHILE there has been considerable study on the subject of the equitable division of the total burden of costs between the various customers of a utility and while various theories of the proper allocation of costs between consumers have been advanced, there seems to have been little consistent application thereof in the practical computation of rate schedules. Rule of thumb or gradual modification of old existing rates has frequently been used and such a process has frequently thrown out of joint any relations which might once have existed between the different classes of rates in a given schedule.

Promotional rates have also helped to increase the disorder, and present rate schedules show such a complication, both in the forms of rates for the same class of service and in the spread between the rates for different classes of service, that an increasing amount of attention and condemnation is being focused upon this phase of rate making. Some of the most drastic critics of present rate schedules go so far as to advocate a single straight charge per kilowatt-hour over large geographic areas without regard to type of use. Some resent most the geographic differences, while others accept those but refuse to admit the necessity for a difference between classes. Some cry for simplification of schedules; others advocate further refinement and consequent complication.

The ideal rate is one which assesses to each customer the true cost of serving him, and the public must be heard when it asks for some demonstration that the wide spread in the cost to different consumers of the same commodity has a reasonable basis. It is difficult for the layman to believe that one customer can be profitably supplied with a commodity at 1 cent per unit, while it costs 10 or even 15 cents per unit to supply the same commodity to another customer. While such a demand of the public is essentially reasonable, to comply with it is not simple. Arbitrary cost allocations have played so important a part in most studies of the problem and qualified experts have differed so strongly on the proper allocation of large items of cost that the most elaborate studies, fortified with charts and tables, have in the end simmered down very largely to matters of opinion.

It is improbable that sufficient data will ever be available to eliminate arbitrary opinion entirely from any study of electric costs. However, it does appear that an approach is possible which will reduce the influence of opinion and increase the influence of ascertainable data, so that the range of debatable difference will be substantially reduced. It has been the purpose of this study to avoid direct apportionment of costs to different classes of consumers and to determine the costs of service so far as possible in terms of the fundamental variables affecting costs. Then the cost of serving a given class of customers can be obtained by assigning to the various variables values which are characteristic of the class in question.

In approaching the matter of cost allocation, it is

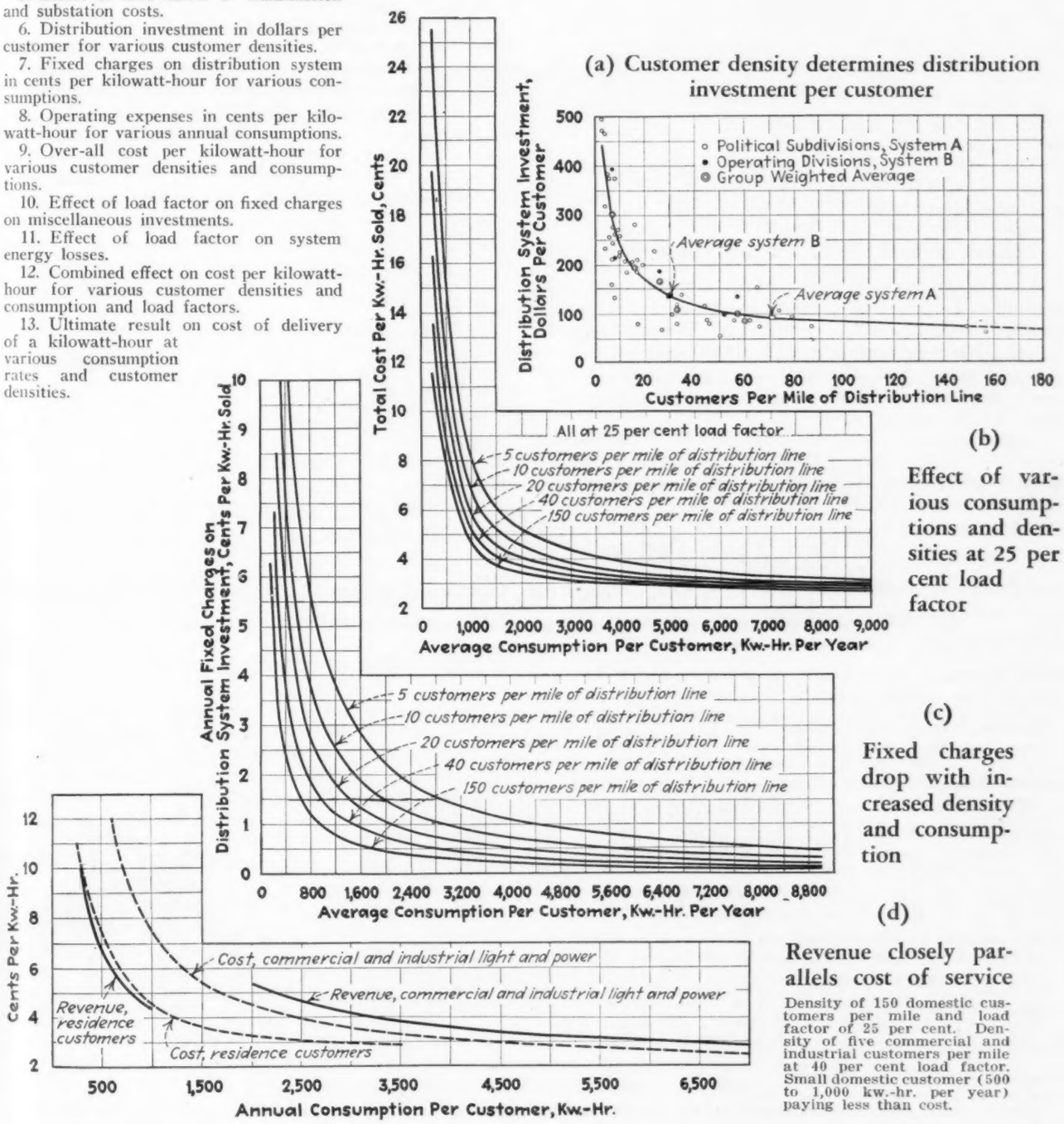
**Adaptation of report of National Association of Railroad and Utilities Commissioners' committee on generation and distribution of electric power, of which Commissioner Kanneberg is chairman.*

desirable to have two things in mind: (1) Segregate all the influences that affect the allocation, and (2) arrange them in logical order. In this study the initial factor recognized is the effect of variable load at the generating station both as to fuel consumption and fixed charges; next the substations, next the distribution system, taking account of the varying customer densities encountered, and finally the over-all assembly of cost factors as established by load factor and customer density. Enumerated in greater detail, the steps may be as follows:

1. Effect of annual load factor or fuel consumption.
2. Apportionment of generation costs other than fuel.
3. Effect of annual load factor or total generation costs per kilowatt-hour.
4. Analyses of trend of investment costs for various parts of the electric system.
5. Effect of load factor or transmission and substation costs.
6. Distribution investment in dollars per customer for various customer densities.
7. Fixed charges on distribution system in cents per kilowatt-hour for various consumptions.
8. Operating expenses in cents per kilowatt-hour for various annual consumptions.
9. Over-all cost per kilowatt-hour for various customer densities and consumptions.
10. Effect of load factor on fixed charges on miscellaneous investments.
11. Effect of load factor on system energy losses.
12. Combined effect on cost per kilowatt-hour for various customer densities and consumption and load factors.
13. Ultimate result on cost of delivery of a kilowatt-hour at various consumption rates and customer densities.

The purpose of this analysis has been to determine the average costs for the entire light and power industry. The basic data for the analysis have therefore not been confined to any one system, but taken from as many sources as were available. Where general data were not available and it was felt that the figures of the system were sufficiently typical, the experience of the Milwaukee Electric Railway & Light Company has been used.

The analysis of generating costs has been based entirely upon steam generation. A similar study of hydroelectric costs would be interesting and valuable, but it was felt that too many variables dependent upon local conditions are involved to make possible a similar gen-


(a) Customer density determines distribution investment per customer
Distribution System Investment, Dollars Per Customer
Political Subdivisions, System A
Operating Divisions, System B
Group Weighted Average
Average system B
Average system A
Customers Per Mile of Distribution Line
(b)
Effect of various consumptions and densities at 25 per cent load factor
Total Cost Per Kw.-Hr. Sold, Cents
All at 25 per cent load factor
5 customers per mile of distribution line
10 customers per mile of distribution line
20 customers per mile of distribution line
40 customers per mile of distribution line
150 customers per mile of distribution line
Average Consumption Per Customer, Kw.-Hr. Per Year
(c)
Fixed charges drop with increased density and consumption
Annual Fixed Charges on Distribution System Investment, Cents Per Kw.-Hr. Sold
5 customers per mile of distribution line
10 customers per mile of distribution line
20 customers per mile of distribution line
40 customers per mile of distribution line
150 customers per mile of distribution line
Average Consumption Per Customer, Kw.-Hr. Per Year
(d)
Revenue closely parallels cost of service
Cents Per Kw.-Hr.
Cost, commercial and industrial light and power
Revenue, commercial and industrial light and power
Revenue, residence customers
Cost, residence customers
Annual Consumption Per Customer, Kw.-Hr.

Density of 150 domestic customers per mile and load factor of 25 per cent. Density of five commercial and industrial customers per mile at 40 per cent load factor. Small domestic customer (500 to 1,000 kw.-hr. per year) paying less than cost.

### *Table I—Division of Generation Expense*

| | Expense in Per Cent | |
|---|---|---|
| | Constant | Variable |
| Fuel | 15 | 85 |
| Operating labor | 98 | 2 |
| Maintenance | 59 | 41 |
| Supplies and miscellaneous expenses | 87 | 13 |
| Total production expense | 33 | 67 |

eral analysis in the time available in which to make this study.

While the operating expenses of a steam-generating plant vary largely with the output, there is a considerable portion which is constant, regardless of the load, and determined entirely by the size of the plant. It is therefore necessary to divide the operating expenses into their variable and constant components.

By far the largest item, about 75 per cent of the total operating cost, consists of fuel expenses. It would seem that an apportionment of fuel costs as 15.3 per cent constant and 84.7 per cent proportional to the output will be satisfactory for our purposes.

The remaining items of generation expense have been arbitrarily divided between their constant and variable components.

## Effect of load factor on fuel consumption

The load factor is the only variable with which we are concerned in this study which affects appreciably the average number of B.t.u. required per kilowatt-hour of output. Each generating station usually operates at a fairly constant and characteristic load factor, which makes it difficult to obtain an empirical determination of the effect of load factor on station economy.

An average curve was derived to represent the conditions prevailing in the industry as the basis of subsequent computations of the effect of the load factor on fuel unit costs. There is no doubt that this question needs further study.

Various operating costs based on the operating results of only one system will not be far from the average conditions found in the entire industry. At any rate, whatever deviation from average condition there may be, the over-all results of the study will not be affected to any appreciable degree, since the operating costs involved constitute only a small portion of the total cost of electric service.

## Variation of fixed charges with load factor

The load factor plays an important part in determining the fixed charges per kilowatt-hour of output, and these are a large part of the total cost of electric generation. The fixed charges bear a direct relation to capacity and the load factor determines the output by which they must be divided.

W. M. Carpenter in the *Annalist* of April 18, 1930, shows the trend of investment per kilowatt of generating capacity in each component of the system for the entire electric light and power industry in the United States. His table shows an average investment in power plants as of December 31, 1929, of $142.26, but this covers both steam and hydro-electric plants. The investment in steam plants ranges from $80 to $130 per kilowatt, with an average of approximately $100. Assuming a reserve capacity of 25 per cent, which appears from analysis of a considerable number of systems to be reasonably representative, we have a power plant investment of $125, which figure has been used in computing the fixed charges.

The charges upon this investment have been computed at 12.5 per cent. This figure is based upon 8 per cent for return, 2.5 per cent for depreciation, which is used for all components of the system and should generally prove adequate, and 2 per cent for taxes, which is the present average rate for the privately owned systems of the United States in terms of the investment in property and plant.

Operating expenses have been assumed to vary with the demand.

### *Table II—Variation of Distribution, Utilization, Commercial, and General and Undistributed Expenses with Average Annual Kilowatt-Hour Consumption Per Customer*

| | Groups of Systems Used in Analysis* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Weighted Averages:** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Number of systems or operating divisions | 19 | 42 | 51 | 27 | 39 | 22 | 6 | 13 | 9 |
| Number of customers per system | 465 | 1,494 | 2,054 | 4,577 | 74,140 | 55,882 | 248,426 | 37,717 | 11,538 |
| Annual sales per system, kilowatt-hours | 206,807 | 1,230,195 | 2,230,403 | 6,217,970 | 162,984,769 | 186,104,514 | 1,000,865,253 | 203,742,724 | 89,716,973 |
| Annual consumption, kilowatt-hours per customer | 445 | 824 | 1,086 | 1,358 | 2,267 | 3,330 | 4,189 | 5,402 | 7,775 |
| **Operating Expenses, Cents per Kilowatt-hour Sold:** | | | | | | | | | |
| Distribution | 1.30 | 0.73 | 0.39 | 0.26 | 0.17 | 0.13 | 0.10 | 0.08 | 0.07 |
| Utilization | 0.50 | 0.25 | 0.15 | 0.08 | 0.07 | 0.03 | 0.05 | 0.02 | 0.01 |
| Commercial | 0.85 | 0.38 | 0.20 | 0.12 | 0.15 | 0.09 | 0.09 | 0.07 | 0.09 |
| General and undistributed | 1.61 | 0.57 | 0.30 | 0.25 | 0.15 | 0.13 | 0.15 | 0.06 | 0.08 |
| Total | 4.26 | 1.93 | 1.04 | 0.71 | 0.54 | 0.38 | 0.30 | 0.23 | 0.25 |
| **Annual Operating Expenses per Customer:** | | | | | | | | | |
| Distribution | $5.77 | $6.07 | $4.23 | $3.47 | $3.92 | $4.35 | $4.25 | $4.34 | $5.18 |
| Utilization | 2.23 | 2.07 | 1.60 | 1.11 | 1.67 | 1.17 | 2.27 | 0.99 | 0.91 |
| Commercial | 3.77 | 3.15 | 2.13 | 1.63 | 3.38 | 2.89 | 3.85 | 3.69 | 7.04 |
| General and undistributed | 7.18 | 4.73 | 3.26 | 3.38 | 3.31 | 4.24 | 6.38 | 3.36 | 5.96 |
| Total | $18.95 | $16.02 | $11.22 | $9.59 | $12.28 | $12.65 | $16.75 | $12.38 | $19.09 |
| ***Basis Used for Grouping the Systems:** | | | | | | | | | |
| Range of average annual kilowatt-hour consumption per customer in systems included in group | 386–578 | 609–888 | 908–1,191 | 1,225–1,530 | 1,673–2,548 | 2,817–3,924 | 4,096–4,274 | 5,070–5,902 | 6,942–7,961 |

An analysis of the experience of sixteen representative systems in various sections of the United States shows variations of annual expenses for transmission, conversion and storage from $0.63 to $4.86 kilowatt of system peak, with an average of $1.98. For the purposes of this study an annual cost of $2 per kilowatt of maximum demand has been used.

Mr. Carpenter shows that for the entire United States the average investment per kilowatt of generating capacity as of December 31, 1929, was $52.25 in transmission lines and $44.92 in substations. Allowing 25 per cent for reserve facilities gives a total of approximately $120.

The distribution component of the cost of electric service consists of the fixed charges on the investment in the distribution system and of the operating expenses in the accounts headed "Distribution," "Utilization," "Commercial" and "General and Undistributed."

The investment in the distribution system is, with the exception of services and meters, which vary directly with the number of customers, determined to a very large extent by the density of customers per mile of distribution line.

### Joint effect of consumption and density

On the basis of the investment per customer at various densities, as obtained from Chart a, Chart c (page 673) was worked out to show the effect of density and consumption per customer upon the fixed charges. The fixed charges were computed at 12.5 per cent, the various values for consumption assumed and the total fixed charges divided by the total kilowatt-hour consumption.

The distribution, utilization, commercial and general and undistributed expenses of 109 systems, both private and municipal, were analyzed and a summary of this analysis, by groups of systems according to the average consumption per customer, is shown in Table II. Chart c shows the effect of density and average customer consumption upon the total distribution costs.

In 1929 the average energy losses of 137 large systems generating 90 per cent of the total energy generated in the United States were 13.9 per cent.* Some correction of generating costs should therefore be made to allow for such losses. Other costs, being on the basis of kilowatt-hours sold, should not be so corrected. The average energy losses of the Milwaukee Electric Railway & Light Company's system for the six-year period 1924-1929, inclusive, were 13.4 per cent, indicating that the experience of this company is fairly typical.

The losses in a given system depend on the shape of the system load curve and, consequently, upon the load factor. To state it in another way, the losses depend on the equivalent hours of the load curve. "Equivalent hours" may be defined as the average number of hours per day which it would be necessary for the peak load of the year to continue in order to give the same total energy loss as that actually given by the variable load throughout the year. Since the losses vary as the square of the load, the equivalent hours of a daily load curve can be obtained by adding the squares of the hourly loads throughout the day and dividing this sum by the square of the peak load for the day.

In order to draw any conclusions from these costs it is necessary to assign values to the variables which are considered typical of each class. There is, unfortunately, a great lack of adequate data upon which to base such an assignment.

### Small domestic customer often served at loss

The domestic customer with an annual consumption of between 500 and 100 kw.-hr. is apparently (see Chart d) paying slightly less than the cost of serving him, while those with consumptions of 1,200 per year or over are paying somewhat more than their share of the costs, particularly when it is considered that such large domestic users will have a better load factor than the average for the group. It is unfortunate that the data on commercial lighting customers and on industrial customers are necessarily grouped together, inasmuch as it is probable that the characteristics of these two groups are quite dissimilar. It would appear that the former doubtless have a greater density and lower load-factor than was assumed in this figure, while the assumption is doubtless correct for the latter. However, the curves indicate that the user in this class with an annual consumption of less than 10,000 kw.-hr. is paying slightly more than his share of the costs and the customer whose annual consumption is above 12,000 kw.-hr. slightly less.

These conclusions, drawn from the cost data assembled, are, as stated above, based upon certain assumed conditions and should be changed in special cases as the actual conditions vary from those assumed. They should also be tempered in particular cases by certain other considerations. Thus a large and rapidly increasing portion of the country's energy is being generated in the larger stations and this reduces the effect of load factor upon fuel consumption.

It should also be noted that in Table II the total of distribution, utilization, commercial, and general and undistributed expenses per customer drops regularly as the consumption per customer increases up to about 1,500 kw.-hr. per year. Beyond this point this figure increases again rapidly, which is doubtless due to the influence of the very high cost of these items for the very large user. Meter reading and maintenance, billing, and cost of acquisition of customers and other items are extremely high for the large industrial user. The same is true of distribution fixed charges, the investment in meters, transformers, etc. These items represent a substantial part of the total cost of service and there can be no doubt that their computations on a per customer basis without regard to the size of the customer exaggerates the effect of annual consumption upon the total cost per kilowatt-hour.

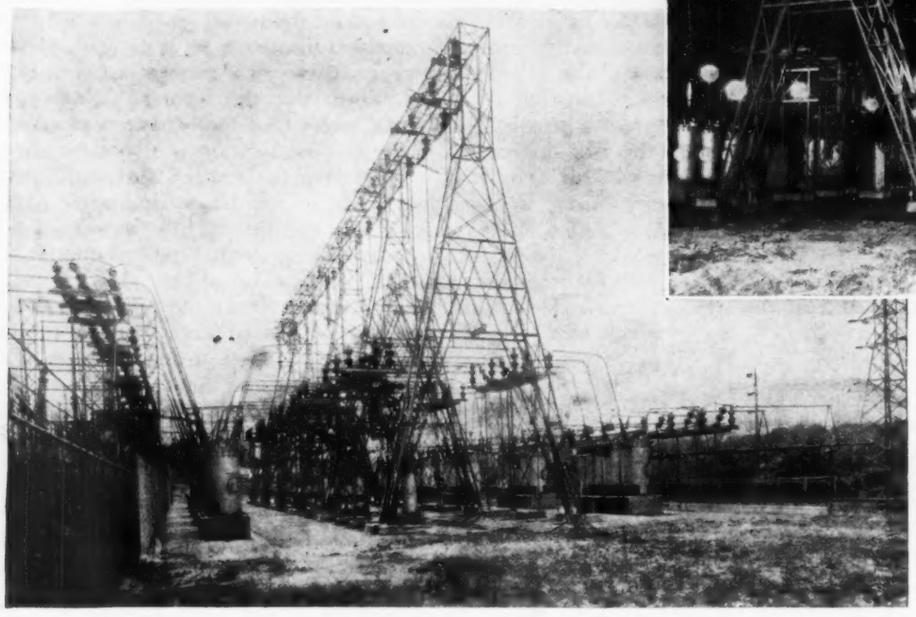
The fact that the residence consumer has a much better diversity factor than the consumer in the commercial and industrial light and power class should also be given consideration. It is hoped to have in the near future some valuable empirical data on the subject of the load factor and diversity factor of various types of customers in all the different classes, but these are unfortunately not yet available. When compiled they will throw much additional light upon the subject of this study.

All of the considerations enumerated above indicate that the actual costs of serving the customers of small annual consumption, and particularly the residence customer, are somewhat less than that found by this study, while the costs of serving the large customer are somewhat higher. It is anticipated that with the acquisition of additional information and with additional study these inaccuracies can be eliminated.

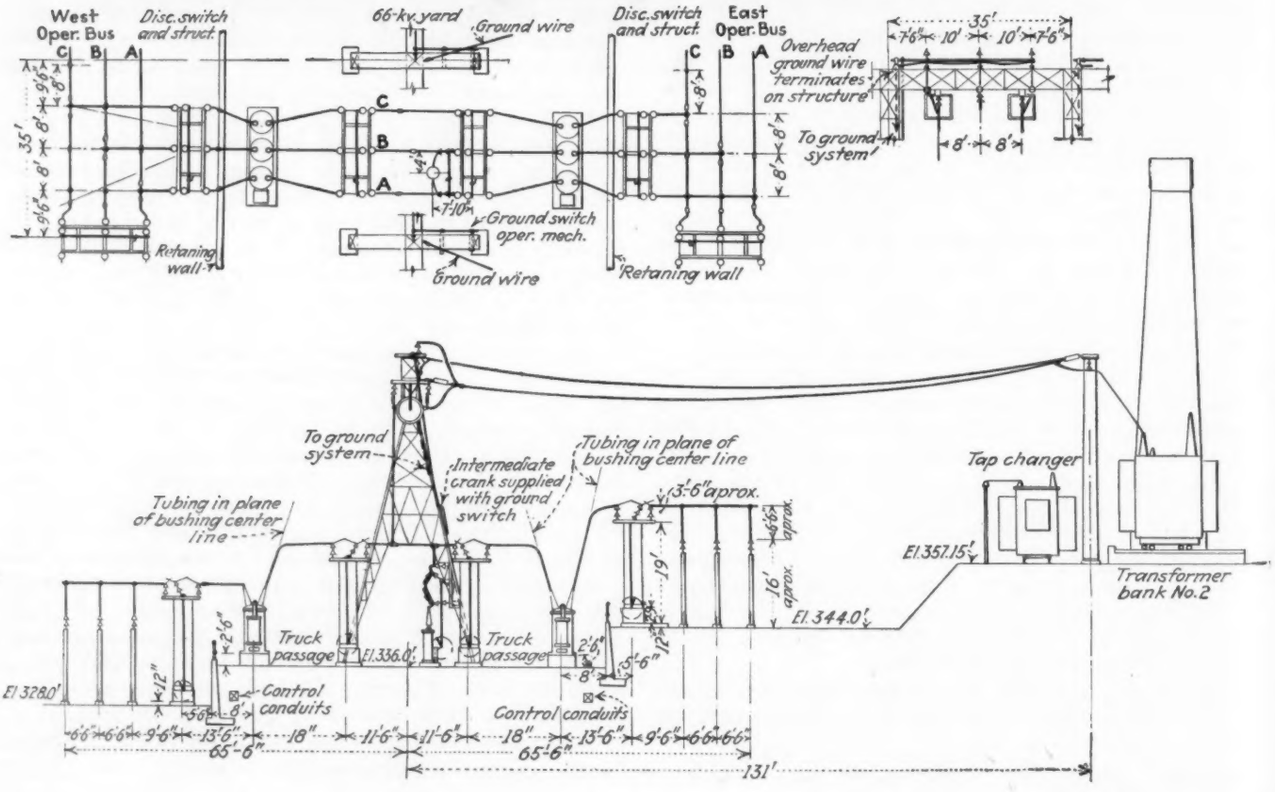
*ELECTRICAL WORLD, *May 3, 1930, page 894.*

# Flat Type 66-Kv. Switchyard Combines Ten Advantages

SIEGFRIED substation is an important 220/66-kv. switching and transforming substation on the system of the Pennsylvania Power & Light Company. In the installation of a second 86,000-kva., 220/66-kv. transformer bank, together with four new 66-kv. circuits, at this substation it proved desirable to adopt a flat type



**Siegfried station by day and night**



of switchyard which would provide these features:

1. Double bus — double breaker installation with increased separation in order to secure greater isolation between kinds of equipment.

2. A design which provides greater working space around breakers and disconnects adjacent to live parts with particular reference to the ready removal of oil-filled bushings.

3. A design that allows motor trucks to drive through the breaker aisles in connection with maintenance work.

4. Simple structural steel unit design for hand-gang-operated disconnect supports.

5. Bus supports which are simple and rugged and thereby expedite maintenance.

6. A design which lends itself readily to the requirements of high current-carrying capacities through the use of large copper tubing buses and connections.

7. A design with accessories which provides for bus differential protection and which may be utilized in such a manner as to cause the least disturbance to the system.

8. A design which materially reduces the number of points of insulator support, thus reducing points of possible flashover.

9. A design that lends itself readily to satisfactory illumination because of the low elevation of the equipment.

10. A design that expedites erection. Construction forces stated that assembly in comparison with truss type structures was the quickest they had ever experienced.

▼ ▼ ▼

# Studies and Surveys Before Network Installation

By CARL W. EVANS

*Underground Distribution Engineer*
*San Antonio Public Service Company, San Antonio, Tex.*

WITH the rapid expansion and increased building in San Antonio in 1927 it became apparent that substantial increases would be required in the cable and equipment supplying power and lights to the underground section in the heart of the city. The same problem had presented itself only a short while before, at which time the solution was a change in primary distribution voltage from 2,300 to 4,000, a change easily effected by passing from 2,300-volt Δ to 4,000 volt Y. The solutions for the situation of 1927 were not so evident and those most feasible were: (a) Additional 4,000-volt primary feeders; (b) the changing to 13,000 primary feeder voltage, and (c) the installation of a low-voltage network with existing 4,000-volt primary feeders and a few new 13,000-volt feeders.

In considering these three propositions the following facts presented themselves: (a) Additional 4,000-volt feeders would take practically all remaining ducts and at the same time only a few years would elapse before the same problem would be faced for a third time; (b) the complete change to 13,000-volt feeders would require considerable increase in investment and would entail the returning to stock of much 4,000-volt equipment, upon which the turnover would be very slow; (c) the latter proposition promised considerable future capacity at a low increment cost and at the same time introduced a considerable increase in assurance of continuity of service. There were many miscellaneous advantages associated with this system, as, for example, the reduced cost of maintenance, resulting from the permissibility of de-energizing feeders for taps, repairs, transformer changes, etc., during regular working hours. After due consideration proposition (c) was approved.

Having approved the installation of a low-voltage network distribution system, it remained to select the specific system to be installed. A survey of the existing systems at that time resulted in the knowledge that out of approximately thirty companies either operating or constructing low-voltage networks there were about eight or ten major variations, either in systems or voltages. A study of the characteristic advantages of each type, with especial consideration to the equipment already installed, resulted in the adoption of a star-connected four-wire distribution system with neutral grounded, the voltage between phase wires being 208 and that between phase wires and ground 120. The eight existing 4,000-volt feeders were to be reconnected as five primary network feeders, and in addition three 13,000-volt feeders were to be installed.

Since the greater number of transformers already in the system consisted of 50-, 75- and 100-kva., single-

**SURVEY SHEET—Manhole No. 112**

220 East Houston
Between Navarro & St. Marys

**PRIMARIES**

Remove both 1 $\phi$ and 3 $\phi$ taps to 4-kv. feeder No. 5 out of ducts 9-2 and 9-W. Rewipe both joints as straight splices.

17-kv. feeder No. 12 will enter in ducts 8-E and 8-W. Route along east, north and west wall racks in position corresponding to ducts and splice between racks No. 1 and No. 2.

17-kv. feeder No. 13 will enter in ducts 7-E and 7-W. Route along east, north and west wall racks in position corresponding to ducts and splice between racks No. 2 and No. 3.

**Material Required:**

Material for two 3-cond., 250,000-c.m., 4-kv. straight splices.
Material for two 3-cond., No. 1 17-kv. straight splices.
7-in. 3-cond., 250,000-c.m., 4-kv. cable fireproofing.
22-in. 3-cond., No. 1 17-kv. cable fireproofing.

**Material to Be Removed:**

1 50-kva. 1 $\phi$ transformers.
1 Noark 1 $\phi$ primary box.
Miscellaneous 4-kv. cable.

**A typical survey sheet**

Specific and detailed instructions on sheets like this one were the result of rigorous inspection and examination beforehand of equipments and conditions on utility and customer properties that would be affected by change-over to the network system. These sheets were typed on thin paper, so that blueprint copies were available to all concerned in the work.

phase transformers it was decided to continue to use such sizes combined in banks of three each. The new 13,000/120-volt transformers were all 100-kva., single-phase units. By limiting transformer banks to a capacity of 300 kva. it was possible to standardize upon one size of network protector, an 800-amp. unit. This size represents full capacity for a 300-kva. transformer bank and permits increase in capacity of other banks by changing transformers only. The existing secondary mains were to be interconnected and in many localities additional cables were to be added.

With such preliminary plans complete, the actual constructional details were begun. Information for this work was obtained in four major surveys: (1) Manhole and duct survey; (2) customer equipment survey; (3) switchboard survey, and (4) meter survey.

The first of these had as its purpose the compilation of all work to be done in the manholes, vaults and ducts. Ducts were selected for the various cables to be installed; routing and splicing in manholes was designated; material required in each manhole and vault was listed, and the location of equipment in vaults was tentatively planned. The survey sheets were worded in such a way that a blueprint copy could be handed to a cable splicer, and if all cables had been pulled into ducts he could proceed with the required splices and cuts without the constant supervision of the underground foreman.

The equipment survey had as its object the determination and location of all equipment which might be expected to operate unsatisfactorily upon the new system with grounded neutral and voltage of 120-208. The judgment of the surveyor was relied upon to a great extent, but the criterion upon which he based his report was that any 220-volt motor operating at more than 90 per cent of rated load would require a "booster" transformer. The first equipment survey was limited almost entirely to motors, but after the actual connecting of the network was in progress it was repeated and covered all equipment, including X-rays, signal systems, etc.

In some particular localities, where the principal load was from one consumer, it became necessary to balance the lighting load of those customers over all three phases of the four-wire secondary service. In order to accomplish this it was frequently necessary to make changes in the customer's switchboard buses. In many cases the work entailed was considerable, since the main switches for 110-220 three-wire service were two-pole switches with solid neutral wiring. A special survey of each of these cases was made, and in the report of the surveyor sufficient information and sketches were given for the electricians to accomplish the change. In every case material lists were included and requisitions were placed early for such material as additional switch blades, crossbars, buses, etc.

The fourth survey, that pertainnig to meters, was necessary since the change to network type two- and three-element meters required considerable attention and, in many cases, reconstruction of meter groups and layouts to obtain balanced condition on transformers and mains. With the completion of these surveys there was available sufficient information to begin the installation.

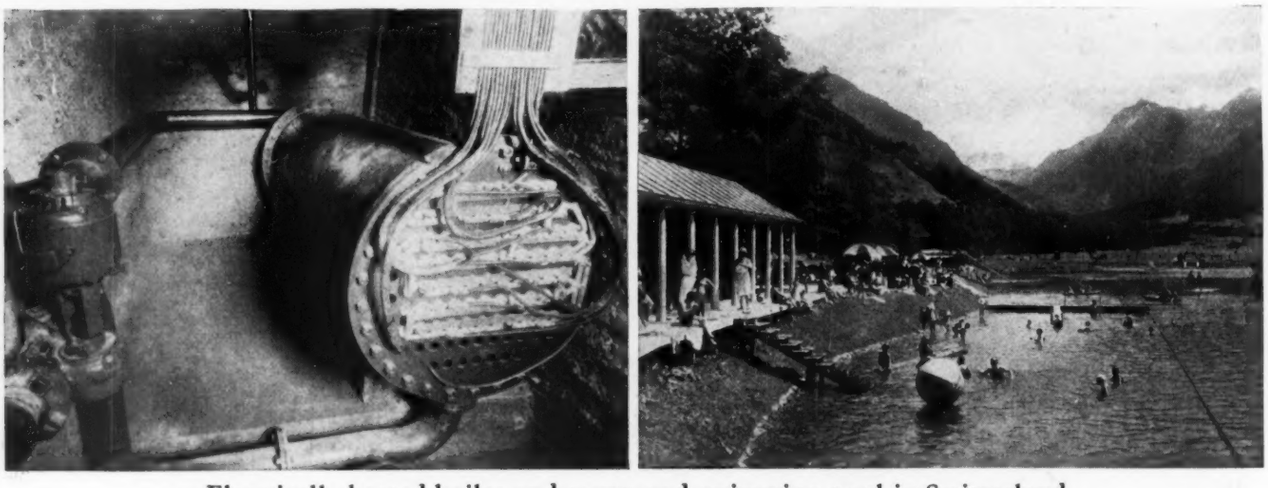
One factor relating to these surveys, which was responsible in a large way for their value, was that in each case the survey was made by two men in collaboration, one man a foreman from the operating division and the other a planner from the office of the electrical engineer. As a result of this combination, the data finally submitted were the resultant of both the practical view of the foreman and the technical consideration of the planner. Later, during the actual installation, there were occasional revisions, but in general the plans of the original surveys were followed with little difficulty and considerable satisfaction.

▼

# Glacier Water Heats Swimming Pool

In Switzerland the application of electric current for domestic and industrial purposes has been highly developed, the melting glaciers providing an abundance of water power. Nevertheless, much of the available energy is wasted, especially at night, because of load conditions and limited storage facilities.

To make use of some of its surplus the Grisons Electric Supply Company at Klosters, Grisons, recently adopted a novel plan. At this well-known tourist resort an artificial pond furnishes storage for the company's 55,000-hp. plant at Kublis. The addition of a pool pro-



**Electrically heated boiler and pump and swimming pool in Switzerland**

vided excellent facilities for swimming, except that the water was too cold—61 deg. F. in the pool and 54 deg. F. in the lake, even on warm summer days.

An electrically heated boiler was therefore installed, to be operated on cheap energy during the night hours. The heating elements are hand-controlled and are in four groups of 100 kw. each; a fifth group is to be installed before next summer. Three-phase current at 867 volts is supplied from an outdoor transformer by way of a four-wire cable, while the ¼-hp., 1,450-r.p.m. motor driving the circulating pump is operated from a separate three-phase circuit at 220 volts, 50 cycles. This motor and the high-speed pump are both of American manufacture.

Hot water is delivered to the pool through a number of nozzles. In warm weather the temperature can be brought up to 73 deg. F., but on the cold days that occurred last summer only 66 deg. F. could be attained. The cost of current is about $8 to $10 a day.

The pool is directly connected to the storage lake. Occasionally this caused difficulty. When the load increased, lowering the level of the lake, warm water flowed from the pool, to be replaced by cold water when the level rose again. This condition is to be avoided by the construction of a small dam between the pool and the lake and by making provision for purifying the water artificially.

▼

# New Ratings for Electrical Machinery

FURTHER recommendations of the International Electrotechnical Commission regarding the rating of electrical machinery were proposed for international use at the recent seventh plenary meeting, held in Stockholm. These recommendations express, as nearly as possible, an international consensus of opinion on the subject, with the hope that they may be accepted for national use with a view to harmonizing the national with the international situation.

New tables of temperature rises for rotating machines and transformers have been prepared and are given in an accompanying table. For apparatus intended to work in tropical climates where the ambient temperature exceeds the standard I.E.C. reference temperature (40 deg. C.), reductions in the temperature rises as given in the accompanying tables have been recommended.

Tolerances in electrical machine ratings previously left unsettled have now been agreed upon and are submitted for national approval.

## *Table II—Temperature Rise Limits for Transformers*

| Windings | Class A Materials | Class B Materials |
|---|---|---|
| | Deg. | Deg. |
| Air-immersed transformers | 55 | 75 |
| Oil-immersed transformers | 60 | 80 |
| Oil, for all transformers | 50 | .. |

## *Table III—Temperature Rises Reduced for Use in Tropical Climates*

| | Reduction |
|---|---|
| | Deg. |
| Rotating machines, classes A and B insulation | 10 |
| Transformer windings, air immersed, classes A and B insulation | 10 |
| Transformer windings, oil immersed | 15 |
| Oil in transformers | 10 |

## *Table IV—Tolerances Allowable in Electrical Machine Ratings*

| | |
|---|---|
| Efficiency by input /output test | 0.15 (1 — efficiency) with a minimum of 0.007 |
| Individual losses (a) of transformers | 1/7 of the guaranteed individual loss. |
| (b) of rotating machines | Individual losses should not be guaranteed |
| Speed variation of d.c. shunt and compound-wound motors (from no-load to full-load) | 1/5 of the guaranteed variation |
| Starting torque of induction motors | |
| (a) motors without slip-rings | 1/10 of the guaranteed torque. |
| (b) slip-ring motors with automatic starting | 1/10 of the guaranteed torque |
| (c) slip-ring motors without automatic starting | No tolerance necessary |
| Maximum torque of induction motors | 1/10 of the guaranteed torque |
| No load current of transformers | 3/10 of the guaranteed no-load current. |
| Impedance voltage, at rated current, of current-limiting reactors, per cent | 15 |

## *Table I—Internationally Specified Limits of Temperature Rise for Rotating Machines*

| Item No. | Winding | Class A Materials: By Thermometer Method (1) | Class A Materials: By Resistance Method (2) | Class A Materials: By Embedded Temperature Detectors: Between Coils in One Slot (3) | Class A Materials: By Embedded Temperature Detectors: Between Outside of Coil and Bottom of Slot (4) | Class B Materials: By Thermometer Method (5) | Class B Materials: By Resistance Method (6) | Class B Materials: By Embedded Temperature Detectors: Between Coils in One Slot (7) | Class B Materials: By Embedded Temperature Detectors: Between Outside of Coil and Bottom of Slot (8) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | (a) A.c windings of turbo-alternators having output of 5,000 kva. or more | | | | | | | | |
| | (b) A.c. windings of salient-pole and of induction machines having output of 5,000 kva. or more or having a core length of one meter or more, deg. | .. | .. | 60 | 50*† | .. | .. | 80 | 75*† |
| 2. | A.c. windings of all turbo-type machines smaller than in item 1 (a), deg. | 50* | .. | .. | .. | 70* | .. | .. | .. |
| 3. | A.c. windings of machines smaller than in item 1 (b) and other than in item 2, deg. | 50* | 60 | .. | .. | 65* | 80 | .. | .. |
| 4. | Field windings of turbo-type machines having d.c. excitation, deg. | .. | .. | .. | .. | .. | 90 | .. | .. |
| 5. | Field windings of a.c. and d.c. machines having d.c. excitation, other than those in items 4 and 6, deg. | 50 | 60 | .. | .. | 65 | 80 | .. | .. |
| 6. | Low-resistance field windings of one or more layers, and compensating windings, deg. | 60 | 60 | .. | .. | 80 | 80 | .. | .. |
| 7. | Windings of armatures having commutators, deg. | 50 | 60 | .. | .. | 65 | 80 | .. | .. |
| 8. | Permanently short-circuited insulated windings, deg. | 60 | .. | .. | .. | 80 | .. | .. | .. |
| 9. | Short-circuited windings, uninsulated. | The temperature rises of these parts shall in no case reach such a value that there is a risk of injury to any insulating or other material on adjacent parts. | | | | | | | |
| 10. | Iron core and other parts not in contact with windings. | The same limits of temperature rise measured by thermometer as shown for the adjacent windings in columns 1, 4, 5 and 8. | | | | | | | |
| 11. | Iron core and other parts in contact with windings. | | | | | | | | |
| 12. | Commutators and slip-rings, open or enclosed | 50‡ | .. | .. | .. | .. | .. | .. | .. |

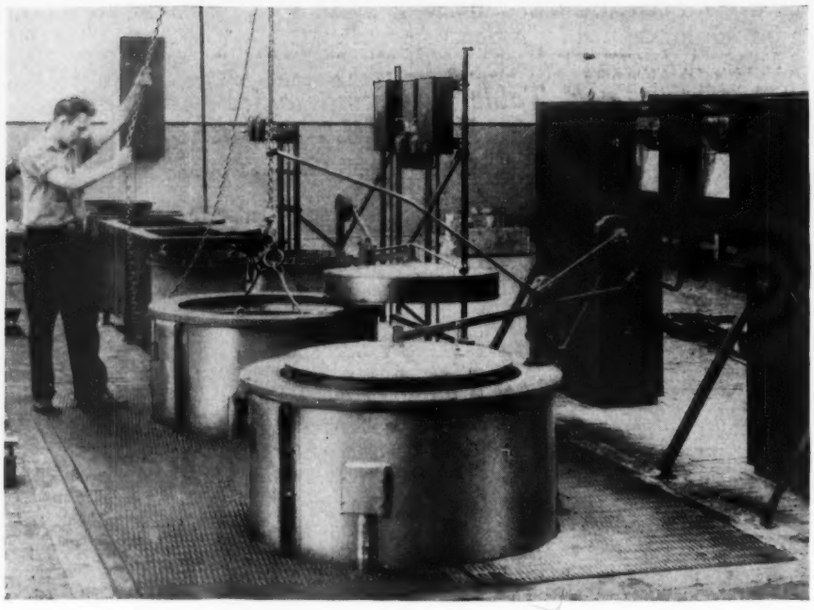
*A correction for high-voltage windings is applicable to these items.

†If desired by the manufacturer in the case of stators wound with one coil-side per slot, the temperature rise may be measured on the copper, inside the insulating tube, in which case the permissible temperature rise shall be 85 deg. C. for column 8, or 65 deg. C. for column 4.

‡This temperature may be exceeded provided (a) the temperatures of insulating materials in the commutator do not exceed specified limits, (b) the manufacturer furnishes a special guarantee, and (c) the temperature does not affect the quality of the soldered joints.

# ELECTRIC HEATING

## Insures Quality Production



**"Homo" furnaces in foreground**

Control cabinets at the right; at the rear are two oil-tempering baths with control switches and Bristol temperature control instruments mounted between cabinets. Leeds & Northrup potentiometer control equipment serves the "Homos."

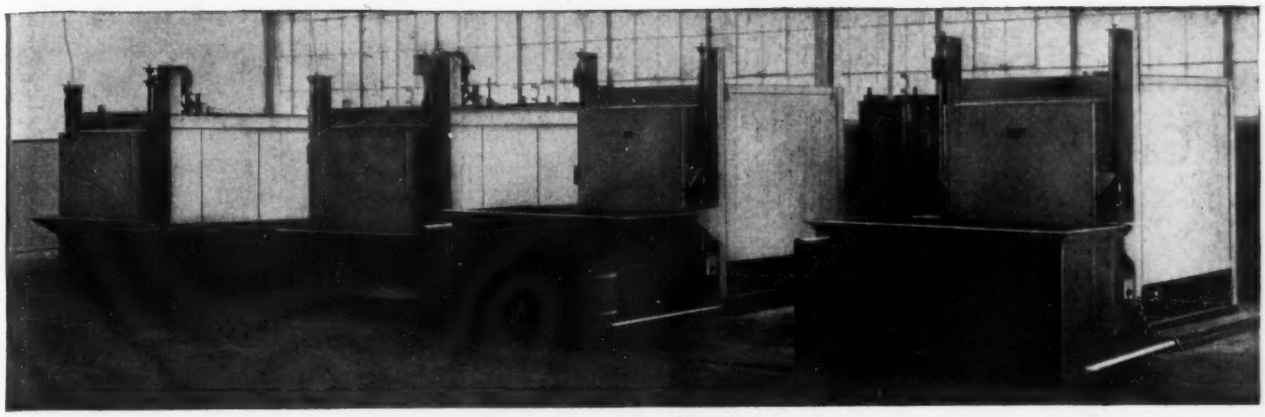
SAFE flying demands materials of the highest grade in aircraft manufacture. Heat-treating processes must be under precision control with continuous duplication of results. In building the new engine factory of the Pratt & Whitney Aircraft Corporation at East Hartford, Conn., twelve major electric furnaces were selected in competition with gas and oil in equipping what is one of the most complete heat-treating departments in Eastern industry. The management assured itself that electricity would provide the best possible service in this responsible field of manufacturing on account of its close control, its accurate adaptation to production needs and the elimination of guesswork. Working conditions closely approach the ideal in this layout.

Carburizing, hardening and miscellaneous heat treating are handled by this installation on a large scale. Ten General Electric heating outfits and two Leeds & Northrup "Homo" furnaces are in service, with a connected load aggregating about 430 kw. All furnaces are installed in pairs with individual control equipment, insuring continuous production in the case of trouble in one unit of any pair. Time switches provide for automatic control of furnace starting and stopping at designated hours, facilitating the operation of any desired units on off-peak night rates (40 per cent less than day rates if used between 10 p.m. and 7 a.m.), and speeding up early morning heating of ovens prior to insertion of work. Energy is purchased from the Hartford Electric Light Company and the heat-treating department is supplied at 220 volts, three phase from the secondary buses of a transformer bank of 1,000 kva. rating installed on a mezzanine floor near the department. Some of the smaller units operate at 110 volts, single phase, this energy being obtained through transformers located near the heating equipment. The necessary carrying capacity in departmental feeder service is obtained by running four 500,000-circ.mil conductors per phase from the terminals of a 2,000-amp. oil circuit breaker in the transformer room to the main distributing panel of the heat-treating department. A watt-hour meter is provided to record

### *Why Electric Heating Was Selected by Pratt & Whitney Aircraft*

After considering the advantages of gas, oil and electricity, says H. J. Fischbeck, chief metallurgist of the Pratt & Whitney Aircraft Corporation, electricity was decided on for the following reasons:

1. High efficiency, together with quality of work produced.
2. Simplicity of application.
3. Close automatic temperature control.
4. Cleanliness and improvement of working conditions; heat-treating room is free from fumes and smoke.
5. Impossibility of overheating any part of the charge, as the temperature of the source of heat is only slightly above that of the charge.
6. Elimination of the combustion method with its attendant uncertainty of results and general fuel problems, plus reduced fire hazards.



**Box furnaces for general heat treating**

These units are provided with automatic reversing mechanism which operates in case a door meets an obstruction while ascending or descending. The furnaces are run continuously and the carburizing cycle is adjusted to 24-hour units by a proper mixture of spent and new carburizing compound. The control apparatus (G. E. and Leeds & Northrup) for each pair of furnaces is concentrated on panels at the rear.

## *Industrial Electric Heating Units at Pratt & Whitney Aircraft Factory*

| No. | Designation | Maker | Kw. Rating, Each | Phase | Volts | Service |
|---|---|---|---|---|---|---|
| 2 | Box furnaces..... | G.E. | 72 | 3 | 220 | Carburizing heavy work |
| 2 | Box furnaces..... | G.E. | 45 | 3 | 220 | Miscellaneous heat treating, medium work |
| 2 | Box furnaces..... | G.E. | 18.5 | 1 | 110 | Miscellaneous heat treating, smaller work |
| 2 | Lead-hardening pots | G.E. | 16 | 1 | 110 | Hardening |
| 2 | Oil-tempering baths. | G.E. | 30 | 2 | 220 | Tempering |
| 2 | "Homo" furnaces... | L. & N. | 50 | 3 | 220 | Tempering |

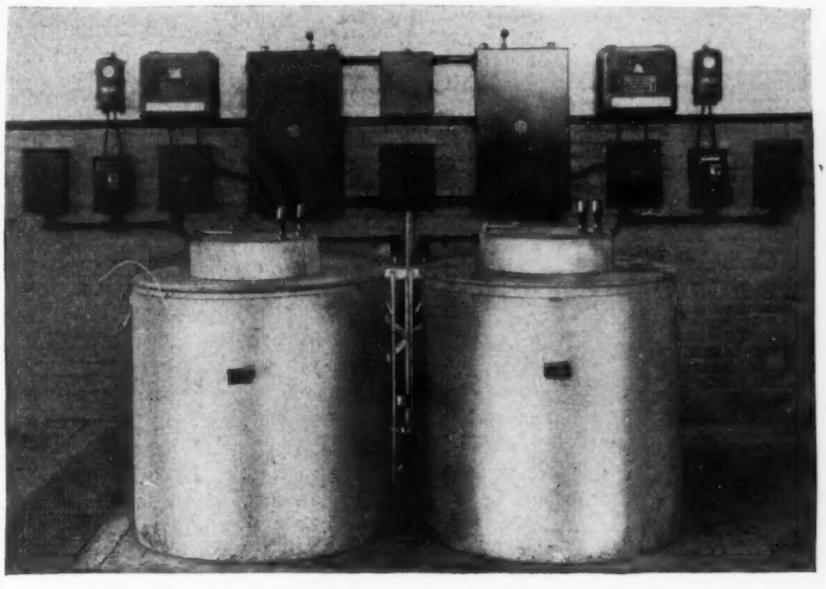
the total input to the department, and the demand is observed regularly at the company's substation in order to control the load economically with regard to the existing rate schedule. This can be done without impairing the performance of the furnaces, as the units are exceptionally well insulated.

The larger furnaces are equipped with 3-hp. motor-operated doors and automatic limit switches that are adjustable for travel, as well as push-button control.

The power wiring layout is the acme of simplicity, each unit being separately fed by tapping the supply through inclosed fuse protection. All wiring is in rigid conduit with the exception of short runs at certain points close to the heating equipment, where flexible armored cable is used. Conduit lines are run overhead to the various furnaces from a central distributing panel on the departmental wall, and connections are made to the control equipment by conduit run under the floor, which is laid with special fire brick. This gives an absolutely unobstructed working space in all parts of the department, and the area allotted to its work is sufficient to permit doubling the present number of units with ease in case future requirements necessitate this.

Control equipment is protected by metal cabinets or dustproof cases, and the facilities for recording temperature cycles, pyrometer readings and control adjustment, while standard, are complete and symmetrical.

With the exception of the "Homo" furnaces, the units were supplied through the Stanley P. Rockwell Company of Hartford, heat-treating engineers and metallurgists, the wiring being done by the Baldwin-Stewart Electric Company, Hartford.



**Single-phase lead-hardening pots**

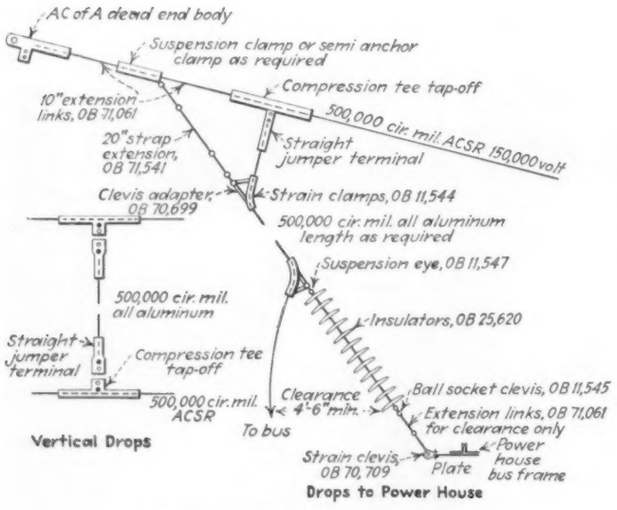
Control and temperature indicating equipment mounted out of the way on the rear wall.

# Making a Difficult Tap on Cable Span

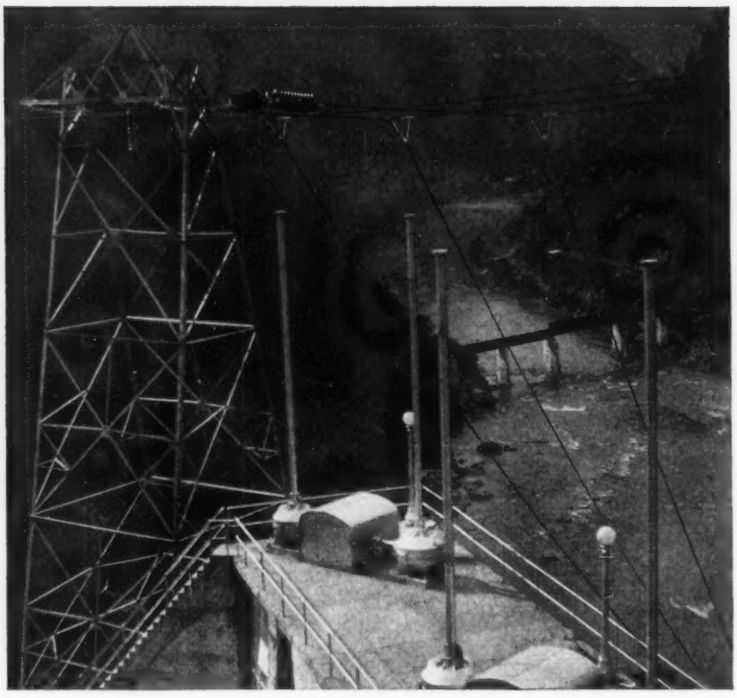
By J. ELMER HOUSLEY
*Alcoa, Tenn.*

A tap was necessary to connect a hydroelectric plant to a two-circuit 150-kv. line in the Southern Appalachian Mountains. The nearest towers were 200 ft. above the power house roof and the penstock headworks prevented the drop cables from being attached to an anchorage on the tower. The use of 500,000-circ.mil all-aluminum cable was selected on account of the light weight and this cable was suspended from the main-line 500,000-circ.mil A.C.S.R. conductor and located about 30 ft. from the tower. The strain is taken by a semi-anchor clamp attached over a wrapping of armor wire; the interval between the anchor and the support from the drop consists of two 10-in. extension links and a 20-in. galvanized strap extension with a clevis adapter which connects to the strain clamp on the drop cable. Electrical contact is made by a compression-type tee tap-off on the span cable, to which is bolted a straight jumper terminal compressed on the end of the drop cable. The accompanying illustration shows a very slight deflection of the main span cable.

The lower end of the drop was anchored to the bus frame on the power house by a conventional insulator assembly and the electrical connection to the bus is made by aluminum compression fittings and tongue and clevis bolted joints, which gives a connection that is perfect mechanically and electrically. Cross connection on the cable bus at the station is made up in similar fashion.


AC of A dead end body
Suspension clamp or semi anchor clamp as required
Compression tee tap-off
10" extension links, OB 71,061
500,000 cir. mil. ACSR 150,000 volt
20" strap extension, OB 71,541
Straight jumper terminal
Clevis adapter, OB 70,699
Strain clamps, OB 11,544
500,000 cir. mil. all aluminum length as required
Suspension eye, OB 11,547
500,000 cir. mil. all aluminum
Insulators, OB 25,620
Straight jumper terminal
Compression tee tap-off
Ball socket clevis, OB 11,545
Clearance 4'-6" min.
Extension links, OB 71,061 for clearance only
500,000 cir. mil. ACSR
To bus
Vertical Drops
Strain clevis, OB 70,709
Plate
Power house bus frame
Drops to Power House

**Details of tap installation**



**Taps 30 ft. out on span**

# British Find Discrepancy in Sphere-Gap Calibration

Studies in sphere-gap calibration have been carried out at East London College in a contribution of the British Electrical and Allied Industries Research Association to the suggestion that further studies be made before the A.I.E.E. standard is adopted by the International Electrotechnical Commission. Technical Report L/T 40 of that association is the subject of a paper by Messrs. Whitehead and Castellain before the Institution of Electrical Engineers (British).

The calibrations for 20-mm. diameter spheres agree substantially with those promulgated as provisional standards by the E.R.A. based on experiments by the British Thomson Houston Company, Ltd., and they do not show much variation from the A.I.E.E. standards. The calibrations for 62.5-mm. diameter spheres also agree with the revised A.I.E.E. figures up to about 50 kv. r.m.s., but are as much as 2 kv. low compared with the latter for voltages above 50 kv. It is concluded that the sphere gap is more reliable than many high-voltage voltmeters at present commonly used in commercial practice. For the lower voltages it can hardly be considered a standard of measurement. A probable error of 0.5 per cent in a mean of four or five readings must be admitted; it has not been found possible to account satisfactorily for the factors which occasion this uncertainty.

The paper comprehensively analyzes the effect of ultraviolet light, ionization, corona, frequency, surface conditions, humidity, nature of metal and proximity of neighboring objects, as well as detailing the method of procedure and measurement.

# Large Investment Trust Believes in Utility Securities

By Col. M. C. RORTY
*Vice-President American Founders Corporation*

**Investment trusts are among the largest investors in securities today. What yardsticks they use and how they determine the merits of a particular security are vital questions to corporations with securities to sell. Colonel Rorty here tells something of how one of America's leading investment trusts gages the attractiveness of utility securities**

IN THE field of investments the first and foremost consideration is always the prospect for development and expansion of the business or industry concerned. Popular estimates of these prospects are, to a large degree, tangibly expressed in stock market prices and yields. A company with an assured rapid growth may have its common shares quoted, in normal markets, at prices approaching twenty times current earnings; a stabilized industry may show quotations of a little better than ten times earnings, while a declining industry or company will show still lower ratios.

At the beginning of any new period of industrial activity the great problem, from an investment standpoint, is to determine what businesses and what industries will share most fully in current technical advances, or will most certainly represent the satisfaction of new luxury and semi-luxury demands.

The outstanding lesson from the last 50 years, or we might even say from the last 100 years, of industrial development in the United States has been that of an amazing continuity of long-term annual increase in physical production. Studies made by a number of observers, and more particularly by Carl Snyder of the Federal Reserve Bank of New York, have shown that this increase in productivity has been at the rate of approximately 3½ per cent per annum. Up to date this increase has not been affected by a declining rate of growth of population. It would, of course, seem reasonable to expect that, as population in the United States approaches stabilization, the annual increment of production will drop below the present 3½ per cent figure, but there are no indications that this drop will be abrupt, or that there will not still remain a long-term annual increase in productivity of perhaps 2 per cent, even after population has ceased to grow.

There is reason to believe that the next great upturn in productive activity will be characterized very largely by new developments in home construction and in household appliances. And, if these developments come, it is safe to say that electricity will have a full and increasing share in the program.

During the ten years from 1920 to 1930 the annual industrial power and light consumption (supplied from commercial central stations) increased in the United States from approximately 163 to 360 kw.-hr. per capita. In the same interval the residential kilowatt-hours per capita increased from 28 to 95. These figures are adjusted slightly to the long-term trend and disregard the current business depression.

If we project present trends ten years ahead, the evidence is that the industrial kilowatt-hours per inhabitant will increase from 360 to 560, or 55 per cent, in the next ten-year period, while a similar projection for residential kilowatt-hours shows an increase from 95 to 185, or 95 per cent, and the prospects are that thereafter the domestic usage should gain in increasing ratio over power consumption.

### Industry should treble

The preceding forecast represents perhaps as distant a view into the future as is possible without excessive margins of error. Nevertheless it is of interest to note that, if trends continue unchanged, and regardless of a declining rate of increase in population, the electric light and power industry in the United States should nearly or quite treble in size before demand becomes saturated.

Such a rate of growth and such prospects appear to be equaled by the figures for no other important industry or public service. The telephone service represents, perhaps, the nearest competitor, but with growth possibilities that are probably less than two-thirds of those for electric light and power.

After assurance has been obtained as to the growth factor of any industry, perhaps the next most important consideration is that of stability of earnings. Industries and businesses that are abnormally affected by variations

in business activity, or that are subject to their own special long cycles of inflation and depression, are less attractive from an investment standpoint than those that possess an inherent stability of earnings. In this respect the electric light and power industry has its very special attractions. The present business depression, as measured by the usual indices, exceeds in severity any for which comparable figures are available. Nevertheless, the gross revenues of the electric light and power industry as a whole, during the year 1930, actually exceeded the revenues for 1929 (the previous high year) by 3 per cent. The only businesses that approach this stability are the food industries and the telephone service. This special stability of the electric light and power industry is, furthermore, tending to increase rather than decrease, by reason of the increasing importance of domestic electric service, which, both as to revenues and as to kilowatt-hours consumed, is very noticeably less variable than power consumption.

## Adequacy of profit margins

Next after rate of growth and stability of gross revenues, in order of importance from an investment standpoint, comes the question of adequacy and stability of profit margins. From this standpoint the electric light and power industry, in spite of the assumed disadvantages of subjection to public regulation, is nevertheless in a particularly favorable situation. First of all, it is very definitely a business of increasing returns. During recent years technical improvements in generating stations, together with improvements in transmission lines and distributing systems and the establishment of superpower networks, have nearly or quite doubled the efficiency of power production and distribution. These technical changes cannot be expected to continue at the same relative rate in the future, but, on the other hand, the industry has now reached a point, in most areas, where generating stations can be expanded at relatively low cost to care for added output, and where distributing systems, in the main, require only the addition of further copper on existing routes to care for increased current consumption.

These continuing possibilities for economies in operation and distribution, and through an intensification of development in existing areas, are perhaps the strongest assurances against harmful regulation of the power and light business by the public authorities. As a matter of fact, there is little, if any, real demand from the general public for reductions in power and light rates. Constant readjustments of schedules will be needed to improve power factors and to stimulate use, but the general level of net earnings of the utility companies is very moderate indeed, and, in fact, is probably under, rather than over, 6 per cent on either the invested capital or the fair physical values, after due allowance is made for depreciation.

The agitation for reduced rates is almost wholly political and the well-managed utility companies have little or nothing to fear from an investigation of their charges and practices. The history of public regulation in the United States has been one with many threatened, but few actual, injuries to the companies involved. The utility companies may very reasonably count upon this history repeating itself.

With growth well assured, with demonstrated stability of earnings, and with reasonable profit margins safeguarded by prospects of continuing economies, in spite of some possible intensification of public regulation, the electric light and power industry stands all reasonable tests from an investment standpoint, including the final test, that of an apparently complete absence of possible competitive substitutions for central-station electric energy.

It is not, however, sufficient for an investor to be satisfied as to the soundness of a business as a whole, since in the end he must buy the securities of individual companies and must judge these companies on their particular merits. In this respect there is a fundamental difference of viewpoint between the private investor and the holding and managing company. The private investor must ordinarily be assured of good management before he purchases his securities. The holding company, equipped with a skilled operating and financial staff, may see in incompetent management its best opportunity to acquire promising properties at low values and to profit from the improvements in management and financing that it may be able to effect.

However, even from the standpoint of the individual investor any examination of electric light and power securities must be based primarily upon territory served and growth possibilities, with only secondary consideration given to existing properties and revenues. Under these circumstances, none of the usual tests of yields or of price earnings ratios can be relied upon. Each company must be studied in the light of its territory, the present degree of development and the revenues and capital expenditures that may reasonably be anticipated under progressive management.

Companies that have been rapidly modernizing their plants and extending their systems of distribution may show poor current net returns, while at the same time a skilled analysis of their position may indicate excellent prospects as the result of an intensified utilization of the backbone plant already installed. In the reverse direction, companies that have been delaying expenditures for modernization may show excellent current earnings, but may be faced with the necessity for heavy capital expenditures without compensating increases in gross revenues.

## Depreciation and reserves

The allowances for depreciation that may be currently adequate in the case of companies with recently modernized plants and with prospects for large increases in gross revenues, without corresponding increases in capital expenditures, may be quite inadequate for companies with obsolete or semi-obsolete plants in backward areas.

On the other hand, companies with obsolete or semi-obsolete plants may be expected to show large decreases in operating ratios when their plants are modernized, whereas companies with modern plants can be expected to show only such more moderate decreases in operating ratios as may result from an intensification of development.

The problem of depreciation charges and reserves is a specially important one for the future. The recent rapid modernization of generating plants and distributing systems has undoubtedly justified a certain deferring of these charges. Differences in accounting practices also make it necessary to consider charges for depreciation and expenditures for current repair as a unit. It is furthermore necessary to make substantial allowances,

as between companies, for differences in the character of operations, the percentages of generating capacity in steam and hydro-electric plants, and other factors. The only general rule that can be laid down with respect to depreciation is that current replacements should be met fully out of charges for depreciation and current repair, and that additional sums should be carried with reasonable regularity to reserve account.

A further general test of the soundness of a company is the trend of added gross revenue in relation to added plant investment. This ratio will vary widely from year to year in the same company, owing to variations in business and construction activity. It will also vary widely as between companies, being generally highest for steam-generating plants with extensive retail distributing systems and lowest for hydro-electric plants that wholesale the bulk of their power. The general trend should, however, be for the ratio of gross revenues to capital to increase as development is intensified, and, in the case of fully integrated steam generating systems, the added gross revenue should approach 25 per cent of the added capital investment, when the increases in both items are summed up for a long enough period to eliminate temporary irregularities.

### Financial statements not the sole index

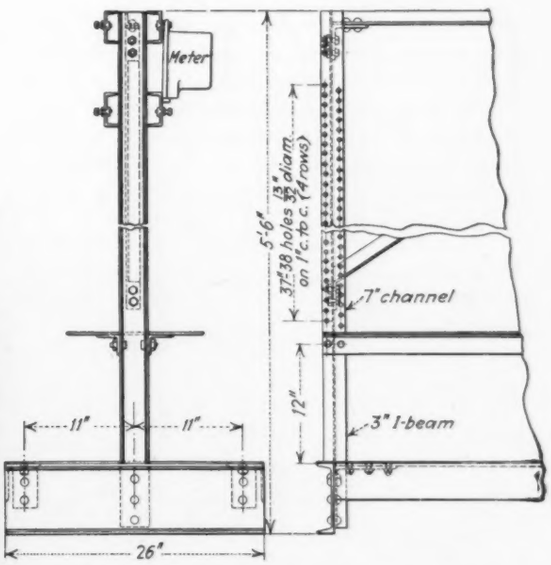
Beyond calling attention to the preceding general considerations, it is difficult to indicate definite tests that may be applied as a guide to investments in power and light securities. Skill and reliability of management, potentialities of territory and favoring trends in operating and other ratios are, in any case, much more important than immediate position as shown by balance sheets and earnings statements. An analysis of a heavily pyramided holding company can be made only by carrying such trends forward for several years and interpreting them in terms of results for the equity issues.

The private investor may feel all reasonable confidence that selected power and light securities purchased at present levels will, in the long run, make handsome returns in combined current yield and appreciation. However, unless he has a personal and intimate knowledge of utility operations, he will do well to trust his choice of issues to reputable investment houses that specialize in the utility field.

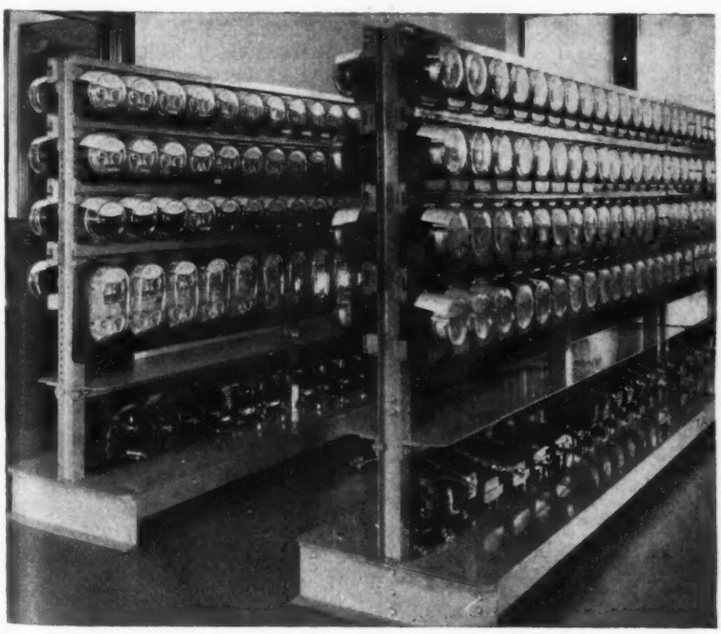
▼

# Unit Racks Conserve Meter Storage

Structural steel meter racks built in 9-ft. long sections with adjustable bar heights provide compact and flexible storage in the laboratory of the Stamford (Conn.) Gas & Electric Company. Seventeen meters per section are normally hung per row, so that the two racks shown in the accompanying illustration will carry 544 5-amp. meters on the upper four rows of the two 18-ft. frames shown, leaving space below for meters of larger size, instrument transformers and other material. Vertical adjustment is effected by raising the horizontal meter-supporting bars from double-end collared studs placed in holes at suitable points in the upright members of the framing, the studs being locked in place when the bars are rested upon the outside of the collars. The meter pins are adjustable as to length and spacing to accommodate various-sized meters. Jigs were effectively used to save time and labor in drilling the framing during erection. The racks were designed by L. C. Smith of the company's engineering department in co-operation with C. E. Waterbury, head of the meter laboratory.

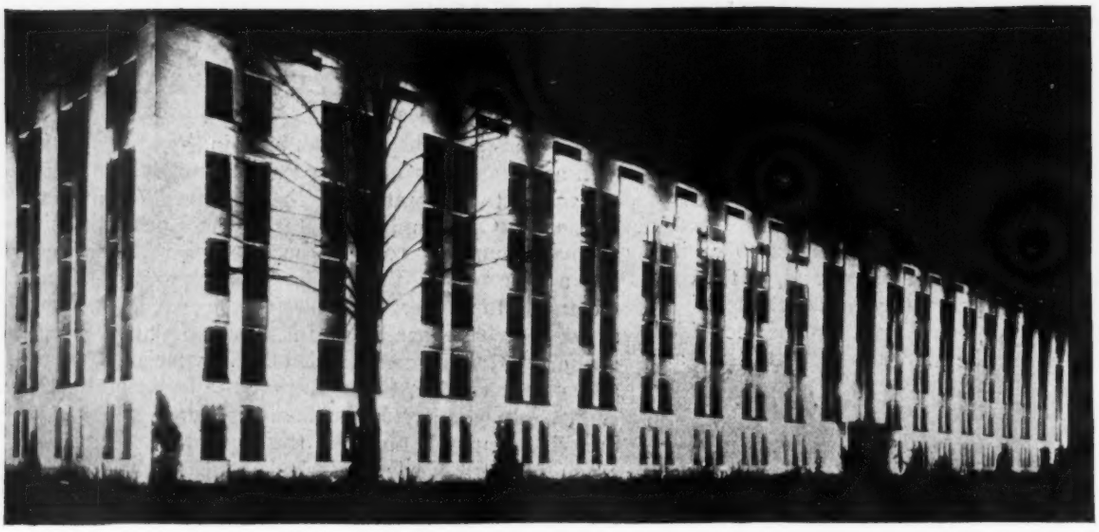



**Side and end elevation of meter rack**



**Rack bars are quickly adjustable for various meter sizes**

# Industrial Building Design F



*The white stone building of the Jewel Tea Company is day and night a landmark in Barrington. Floodlighting is afforded by 33 units equipped with 250-watt lamps. If higher intensity is desired 500-watt lamps can be used.*

**By B. W. BERNSTEIN**
*Holabird & Root, Architects, Chicago, Ill.*

FLEXIBILITY to admit changes and rearrangements and ease of extension for future growth characterize the electrical installation in the new Middle West plant and executive office of the Jewel Tea Company at Barrington, Ill. The same symptoms of modernity are expressed in the building, designed by Holabird & Root, architects, in which the plant is housed. They characterize also the company itself, although the 30 years in which the Jewel Tea wagons of yesterday and the motorized equipment of today have been familiar objects on the highways and byways of the country might excuse even an ultra-conservatism.

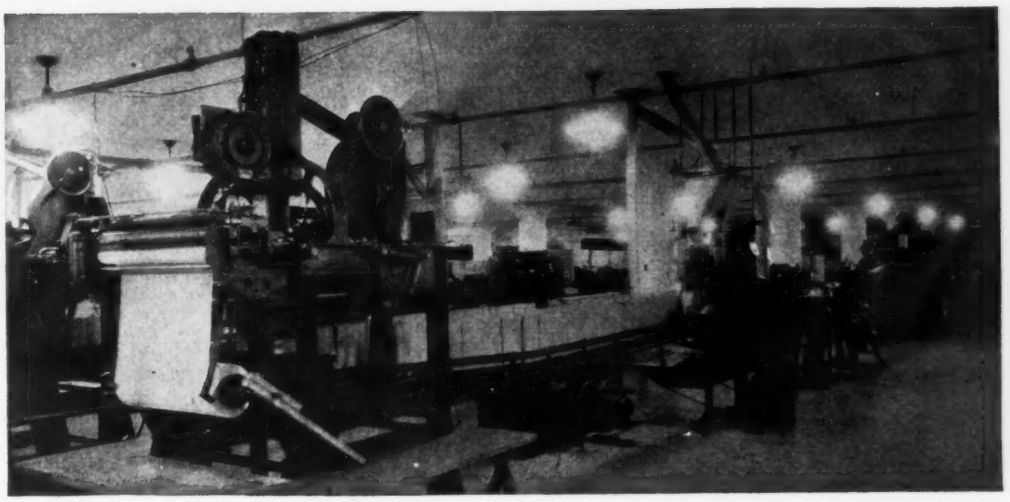
The most obvious evidence of up-to-dateness in an industrial electrical installation is the lighting, and in this respect, both literally and figuratively, the new Jewel plant shines. Literally, because, atop the ground rise on which it stands, the building, 400 ft. long, 100 ft. wide and five stories high, is bathed in floodlighted radiance that brings out the simple lines of its design and plays up the contrast between the whiteness of the Bedford stone walls and the blackness of the spandrels below and above the windows. Figuratively, because every operation and function in the building was studied and is supplied with the intensity and kind of light it needs.

The plant is a combination factory, warehouse and general office. The electrical layout is such that spaces devoted to any one of these functions may be readily adapted to the uses of either of the two others. All branch feeders are of sufficient capacity so that new plant or office departments may be added, or an existing department moved, anywhere in the building. Convertible type distribution cabinets are used throughout so that circuits may be changed from 30 to 60 or 100 amp. capacity simply by changing panel sections in the cabinets. The power load totals 560 kw. in 174 motors, mostly in small sizes. The installation will permit the use of 500 kw. in lighting when future conditions require it, although at the present time the connected lighting load is below this figure.

The principal manufacturing operations are the processing of coffee and the weighing and packaging of this and other commodities. At the north end of the building is located the coffee-roasting equipment. The green coffee is unsacked on the fourth floor, dropped to the third, where it is milled and returned to the fourth floor for mixing, then carried by bucket elevators direct to the hoppers just above the roasters on the fifth floor. After roasting, the beans are moved by gravity to the stoners on the fourth floor, after which the coffee is lifted by suction to hoppers on the roof, and from there to roasted coffee bins on the fifth floor. From here it is led to granulators and normalizers (in the case of ground

**Flexibility of lighting and other electrical services stand out in the design of this industrial plant. Requirement of interchangeability of spaces for manufacturing, office and warehousing uses calls for wiring adequacy throughout the building.**

# Features Good Lighting



**Fourteen foot-candles provided in this packaging room**

Coffee and other products are weighed and packed in cartons by these machines. Although they are wholly automatic, they do need supervision and inspection of their operations. For this reason a fairly high general illumination is supplied.

coffee) and next dropped to flow bins on the third floor. These regulate the flow of ground coffee to the hoppers on the second floor, from which the triple-sealed, parchment-lined cartons are filled. There are two units of coffee packaging machinery on this floor, a 2-lb. and a 3-lb. size, and each of these is equipped with a carton former, a liner and a bottom sealer, weighing and filling machines, exact weight check scales, top sealer, label and wrapping machine, and carton sealer. After packing, the cartons are dropped by chutes to the trucks for shipping on the first floor.

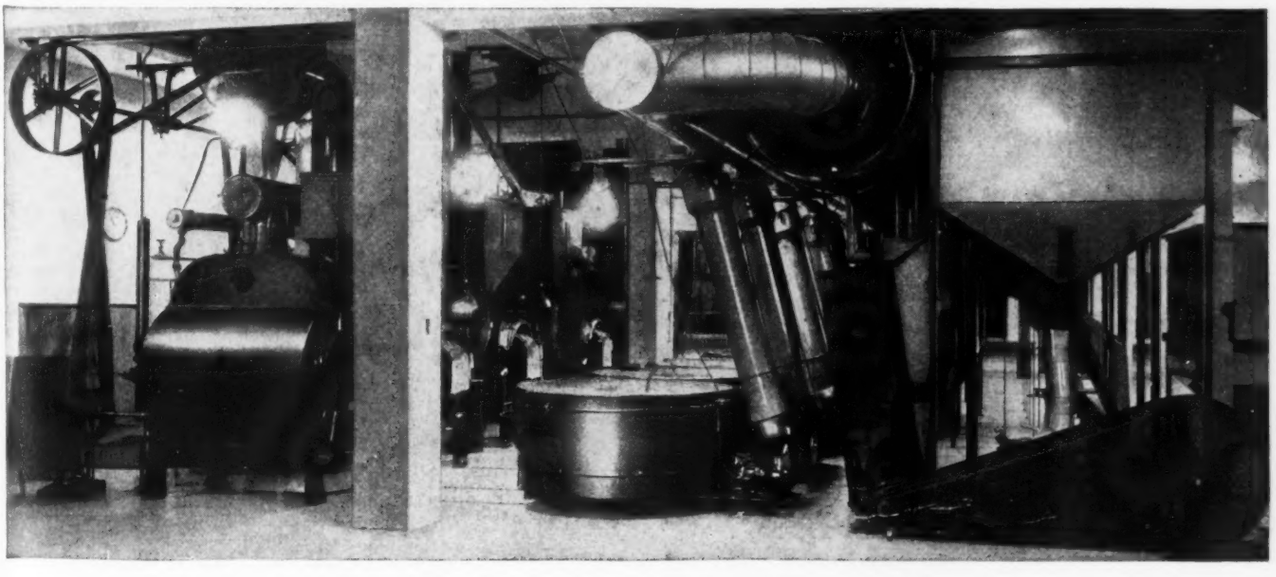
The enire work of milling, mixing, roasting, stoning, grinding and processing is automatic in every respect, and not once, either in processing or conveying the whole or ground beans from one unit to another, are they touched by hand.

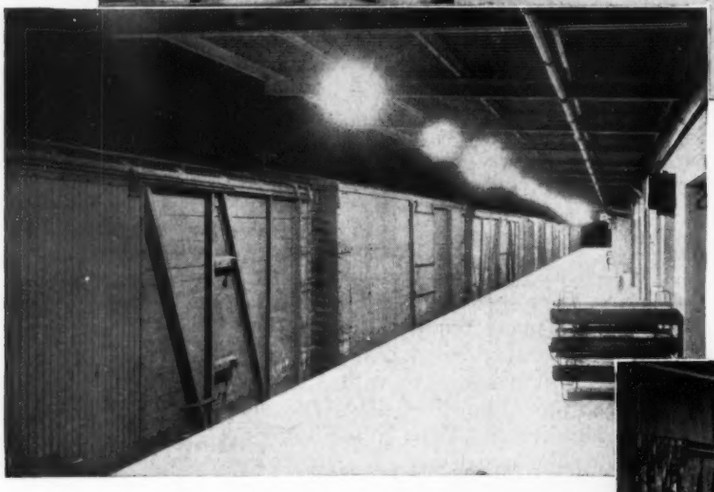
The many requirements for lighting in this building for manufacturing, office, storage and loading spaces, auditorium complete with stage, home service kitchen, laboratory, bowling alleys and squash courts are of a wide diversity. The coffee beans are graded and sorted for color under daylight lamps. In spaces used for handling and packing finely powdered materials, such as baking powder, cocoa and pulverized spices, dust-tight units are necessary.

Along the bowling alleys are angle type reflectors and

**General illumination in this coffee-roasting room is 8 ft.-candles**

25 ft.-candles is provided at local points where inspection of the process requires.





# The Applied Art of Good Lighting

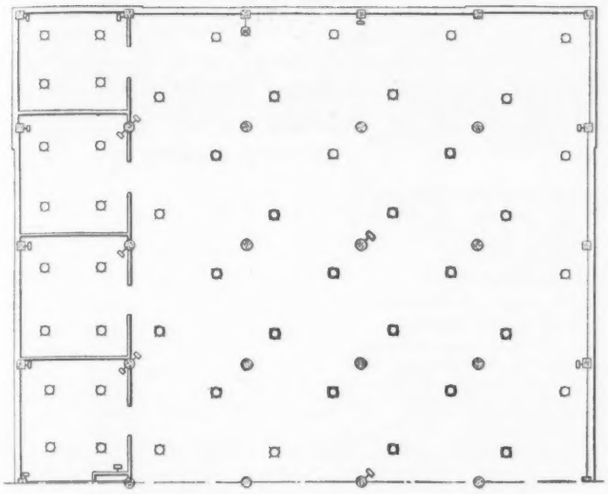
These views, and others reproduced on adjacent pages, were all made at night, with no added light source for the camera. They show the effectiveness and adequacy of modern lighting equipment when used with skill and intelligence.

(At top) *General storage space*—300-watt lamps in 18-in. RLM domes, hung 10 ft. high on 14-ft. centers, for a floor intensity of 12 foot-candles.

(Left, center) *Loading platform*—200-watt lamps in 18-in. RLM reflectors, on 15-ft. 6-in. spacing for a floor intensity of 6 foot-candles.

(Right, center) *President's office*—Note desk lamps with opaque tops and diffusing glassware.

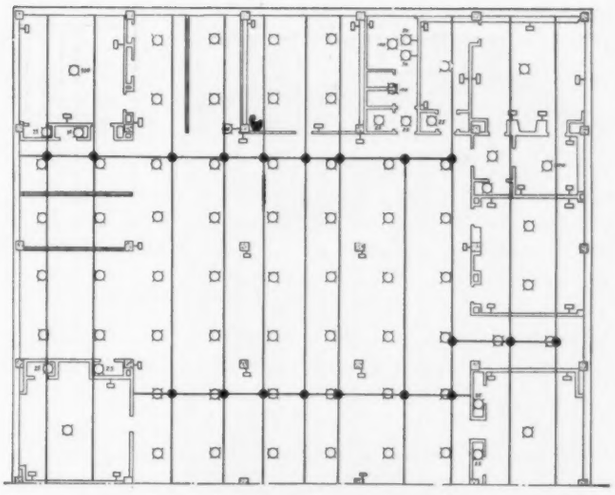
(Below) *General office*—200-watt lamps in inclosed units, hung 11 ft. 6 in. high on 10-ft. centers for 12 foot-candles at desk height. The glassware will accommodate 300-watt lamps if desired later.



□ Ceiling outlet-300 watt
□H Convenience outlet-100 watt, wall mounted
□H Wall bracket outlet-50 watt, watchman's light

**Symmetrical arrangement includes frequent convenience outlets**

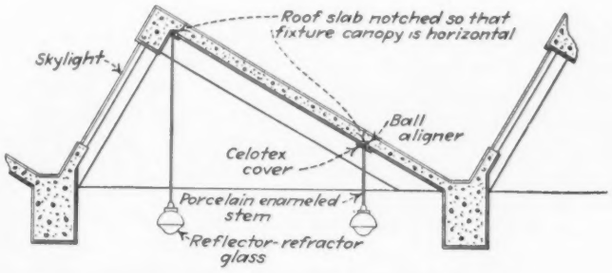
Note the one-way quartering of lighting units on approximately 14-ft. centers in the 20-ft. column bays. This makes a symmetrical arrangement and eliminates column shadows.



□ Ceiling outlet, 300-watt capacity, 200-watt lamps
□H Wall bracket outlet
□H Convenience outlet, wall mounted, 100-watts
—— Underfloor ducts
● Underfloor duct junction boxes

**Under-floor ducts a feature of office layout**

Different from the plant areas, the 20-ft. column bays are quartered both ways, resulting in a 10-ft. lamp spacing. The heavy lines indicate separate under-floor ducts for floor type receptacles and telephone outlets.




**Fixture suspension in general office**

The sawtooth skylight roof necessitated special devices for hanging the lighting units. The fixtures are stem-suspended on ball aligners. Six-inch square horizontal recesses are provided for the lamp outlet boxes.

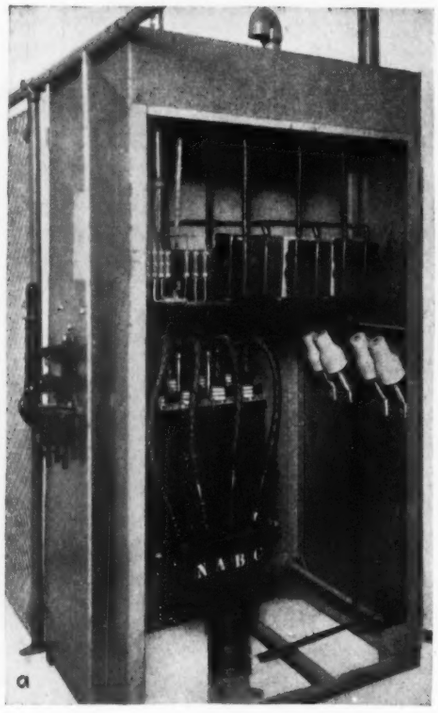
spot lights over the pins. In the squash courts twelve 600-watt flush ceiling fixtures with prismatic lenses light equally the walls and floor. The details of the installation are presented in the accompanying table and illustration captions.

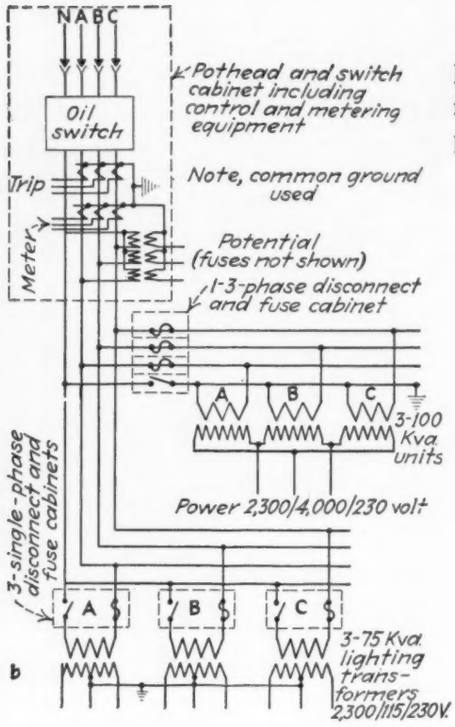
Conspicuous in the service vault at the new Jewel tea plant is the total absence of open construction. The unit primary cabinet into which the three-phase, four-wire, 2,300-4,000-volt cable goes from the distribution system of the Public Service Company of Northern Illinois contains the disconnecting pothead, the oil circuit breaker and the metering and tripping current and potential transformers. From this cabinet the primary runs to the transformers are in metal conduit, as are also the

## *Characteristics of Lighting Installation Summary*

| Space | Type of Fixture | Watts per Fixture | Spacing | Mounting Height | Foot-Candles | Color of Ceiling | Color of Walls | Remarks |
|---|---|---|---|---|---|---|---|---|
| Main office | Holophane No. 2140 6-in. glass | 200 | 10 ft. 0 in. x 10 ft. 0 in. | 11 ft. 6 in. | 12 | Natural Celotex | Natural Celotex | Sawtooth skylight ceiling |
| President's office | Special design, semi-indirect | 500 | ..... | 10 ft. 0 in. | 9 general 20 local | Light cream | Butternut | ..... |
| Auditorium | Direct-inclosing glass | 300 | 10 ft. 0 in. x 10 ft. 0 in. | 10 ft. 0 in. | 10 | Warm gray | Warm gray | ..... |
| Stage | ..... | ..... | ..... | ..... | 3 to 40 | ..... | ..... | ..... |
| Coffee roasting department | 18-in. standard dome | 300 W.B. | 10 ft. 0 in. x 10 ft. 0 in. | 10 ft. 0 in. | 8 general 25 local | Dull white | Dull white | Lights omitted over high machines |
| Chemical laboratory | 18-in. Glassteel units. | 200 | 10 ft. 0 in. x 10 ft. 0 in. | 9 ft. 0 in. | 10 | Dull white | Borrowed lights | ..... |
| Storage space, fourth floor | 18-in. standard dome | 300 W.B. | 10 ft. 0 in. x 20 ft. 0 in. stagger | 9 ft. 0 in. | 12 | Dull white | Dull white | For future manufacturing |
| Inspection and premium department | Total indirect | 300 | 10 ft. 0 in. x 10 ft. 0 in. | 9 ft. 0 in. | 8 | Dull white | Bright blue | ..... |
| Coffee packing department | 18-in. standard dome | 300 W.B. | 10 ft. 0 in. x 20 ft. 0 in. stagger | 9 ft. 0 in. | 14 | Dull white | Dull white | ..... |
| Cafeteria | Special indirect | 100 | 10 ft. 0 in. x 10 ft. 0 in. | 9 ft. 9 in. | 2½ to 3 | Gray | White | Wall is striped gray, dark at floor, light at ceiling |
| Loading platform | 18-in. standard dome | 200 W.B. | 15 ft. 6 in. | ..... | 6 | Gray | Gray | ..... |
| Electric switchboard room | 18-in. standard dome | 300 W.B. | ..... | ..... | 8 | White | Gray | ..... |
| Boiler room | 18-in. standard dome | 300 W.B. | ..... | ..... | 5 | White | Gray | ..... |

Note—W. B. after lamp wattage indicates white bowl.




**Power supply facilities and primary cabinet**

secondary runs. Three-phase power at 230 volts is supplied from a bank of three 100-kva. transformers connected with Y primaries and delta secondaries. The primary neutral is normally open, but it may be closed in order to provide open delta operation if a transformer is burned out. The three 75-kva., 2,300/115/230-volt lighting transformers are independently connected on the three phases and their loads balanced in the building wiring. Arrangements on the secondary switchboard permit this balancing and also provide for redistribution of the load between the remaining two if one of the transformers should fail. All transformer primary connections on both light and power are made through cutouts, which are inclosed in metal cabinets, those on the phase legs being fused and the neutral unfused. Arrangements are made in the construction of the cabinets so that a panel of each fuse cell can be removed for fuse inspection without interruption of service.

▼

# The Appraisal of Glare

By M. LUCKIESH

*Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio*

There are two general methods for determining the effects of glare. In one of these the subject of the experiment is asked to report on the unpleasantness or discomfort resulting from the presence of the glaring light source. More reliable results are obtained if the experiment is so arranged that the subject compares the relative glare from two light sources in this respect. This method has the advantage of being the most sensitive one that has been devised. However, it leaves much to be desired, chiefly from the lack of adequate definition of the exact thing which the subject is to appraise.

The second method consists in measuring the visibility of an object under various conditions of glare, the object itself having nothing to do with the glare conditions. This method has the advantage of definiteness and fair precision. It is emphasized that the two methods described are not methods for appraising the same thing. They are to be considered as approved methods for determining the effects of glare in terms of discomfort and of reduced visibility, respectively.

The results from an experiment in which the effect of glare is appraised in terms of discomfort are presented in the following table. A clear lamp and a frosted lamp of approximately equal candlepowers toward the eye were compared with two different glare sources: (1) A diffusing surface 3 in. in diameter and (2) the bare filament of a clear lamp. The subjects adjusted the candlepower of the comparison glare source until the test source and the comparison source seemed equally glaring.

| Test Lamp | | Candlepower of Comparison Glare Source for Equal Discomfort | |
|---|---|---|---|
| Type | Candlepower | Diffusing Surface | Bare Filament |
| Frosted | 38.8 | 27 | 15 |
| Clear | 41.5 | 42 | 25 |

It will be noted that the clear test lamp produced a greater glaring effect (appraised by discomfort) than did the frosted lamp in both comparisons. The data presented indicate that the discomfort per candlepower of the glare source is nearly twice as great for the bare filament as for the diffusing surface.

When a glare source is appraised in terms of reduced visibility, it has been established that the degree of impairment of vision is almost entirely a function of the intensity of illumination produced at the eye by the glare source, the brightness and area of the glare source being of little or no importance. If the same glare source is appraised by both methods, a glare condition which may be judged quite uncomfortable often shows no detectable reduction of visibility. It follows that a glare condition which appreciably reduces visibility is certainly an adverse condition for the eyes.

# Dealers Take Over the Merchandising Job

**What is this Long Beach merchandising experiment? What is the present status? Will it succeed or fail? What is the attitude of the power company, the dealer, the manufacturer and the jobber?**

By W. C. HESTON

*Pacific Coast Editor* ELECTRICAL WORLD

CAN dealers take over major appliance selling and do a load-building job satisfactory to the power company? The answer is expected to emerge from an experiment now being conducted in Long Beach, Calif. Here, by agreement with the Electragists, Long Beach merchants and electrical dealers, the Southern California Edison Company, Ltd., withdrew from major appliance selling on October 1, 1930, to give dealers fifteen months, or until December 31, 1931, to demonstrate what they can do.

It is too early to predict the outcome, but after four months' operation of the plan certain things stand out, and if enthusiasm will put it over the dealers will surely win. However, according to dealers, two things are vitally wrong under the present set-up, on ranges in particular. First, the margin of profit is not sufficient on electric ranges to enable the dealer to put the necessary advertising, promotion and selling effort back of them to insure volume. Second, manufacturers and distributors must give dealers the same degree of co-operation they did the power company in the way of advertising, training of salespeople, cooking schools, demonstrations, etc. These things the dealers confidently expect will soon be rectified, otherwise they must admit failure before they start. Already several range manufacturers and distributors have increased discounts to around 40 per cent, but the margin is still too low. The gross profit on electric ranges is only about 58 per cent of what it is on gas ranges and the household goods dealer's tendency naturally is to take the line of least resistance and lean to gas. It is reported that a movement is under way by manufacturers to place the electric range on a sound merchandising basis so that dealers can make a legitimate profit. With only one exception local representatives of range manufacturers admit the truth of the dealer's contention. This representative is not willing to admit that volume can ever be secured through the dealer. As to co-operation, one large manufacturer has already taken steps to lend his full support, and others no doubt will follow as a natural consequence.

Before pointing out other weaknesses in the present situation it will be well to tell something of the plan. The Edison company withdrew eight range salesmen when the plan became effective. Since October 1, 1930, the company has sold table appliances only at its district office, leaving a clear field for the dealers on major appliances. Eleven dealers went in on the plan, three department stores, four electrical stores, two furniture stores and two hardware stores. Of these, one electrical specialty shop has gone out of business and one furniture store dropped out due to lack of display space, leaving nine dealers still participating.

At the outset it was agreed that co-operative newspaper advertising would be carried during the power company's nine-week fall range campaign from October 1 to December 12. The power company matched column inches of space with the dealers, each running a total of 540 column inches, or a combined total of 1,080 inches. Each power company had carried a list of participating dealers at the foot of the ad. The company maintained a range salesman on its floor who handed prospects a card listing dealers selling ranges. Approximately half the time of the local secretary of the Electragists was spent in Long Beach during the first 45 days of the trial to get things running smoothly.

So far the plan can hardly be said to have been successful. Dealers realize that they got away to a poor start, but they are still optimistic and confident. Up to the first of February, 1931, dealers had sold 27 ranges retail, according to the best check that

The following Dealers display, demonstrate and sell fast-cooking ELECTRIC RANGES, at terms to suit your convenience, in co-operation with the Southern California Edison Company, Ltd.

DEPARTMENT STORES

| | |
|---|---|
| Parmalee-Dohrmann Co. | 520 Pine Ave. |
| Sears Roebuck and Co. | 5th and American |
| The Wise Co. | Broadway at Pine |

ELECTRICAL STORES

| | |
|---|---|
| Baty Electric Co. | 128 W. 4th St. |
| Blomskog Electric Shop | 412 American |
| Kuster-Wetzel Electric Co. | 214 E. Broadway |
| Mills Electric & Radio Co. | 328 Pine |

FURNITURE STORES

| | |
|---|---|
| Barker Bros. | Broadway at Locust |
| Phillips Furniture Co. | 630 Pine Ave. |

HARDWARE STORES

| | |
|---|---|
| American Ave. Hdwe. Co. | 437 American |
| Horace W. Green & Sons Hdwe. Co. | 548 Pine |

**Range prospects calling at power company's office were handed this card listing dealers selling electric ranges**

could be made. In addition 45 ranges were sold to apartment houses wholesale by range distributors. This is a total of 72 ranges, or approximately one-fourth the quota of 300 set for the dealers by the power company in one-fourth of the trial period. This does not compare favorably with former sales of the power company, but there are several reasons why. During 1929 the Edison company sold 292 ranges retail, 222 more were sold at wholesale, and dealers sold 16. In 1930 the power company sold 213 retail, 141 were sold wholesale and dealers sold 11. The power company's quota for the fall campaign for Long Beach, with its 45,000 residential meters, would have been 216 ranges. Sales for the system as a whole during the campaign were about 80 per cent of quota and, applying this percentage to Long Beach, probable sales would have been 172 ranges. As against this dealers and distributors sold only 72 ranges in a month's longer period. However, these figures cannot and must not be taken literally because they do not prove the case one way or the other.

### Dealers are handicapped

In all fairness to dealers, certain handicaps must be recognized. In the first place dealers took over the business at an inauspicious time, for two reasons. Business conditions are poor in Long Beach and probably worse in proportion than in other southern California communities. That sales of major household equipment are way below normal in Long Beach is evidenced by the fact that gas range sales in 1930 were only one-third of normal volume. People are not spending money for major appliances. The other important factor is that the electric range has not received sufficient public acceptance in the territory to enable dealers to carry the full sales burden. Only about 1,000 ranges are now served in Long Beach, which is a saturation of less than 2¼ per cent.

How dealers can be expected, or they can expect, to develop a wide public acceptance from this point without some active sales support from the power company is hard to answer. If they can do it they have done next to the seemingly impossible. Power companies in the Pacific Northwest that have been so successful in selling ranges do not figure that they are over the knee of the public acceptance curve until a saturation of at least 15 per cent has been reached. In the case of Long Beach, 5,750 additional ranges must be sold to reach this saturation.

The Edison company was in a fair way to sell the idea of electric cooking in a reasonably short period of time, as evidenced by the 1929 and 1930 sales given above, but it was doing this by high-pressure selling with six to eight experienced salesmen capably supervised. Some far more comprehensive sales plan than the one now in effect in Long Beach must be set up before dealers can ever hope to put the job over alone. These things the dealers recognize, and on February 15, 1931, a full-time range specialist, to work 60 days under direction of the Electragists, was employed to work with dealers and supervise sales promotion. This is a step in the right direction and should bring results.

Several other things have worked to the disadvantage of the dealers. Lack of sales supervision and some better method of handling prospects secured by the power company are two of these. Sales supervision and co-

Let Your Electric Range
Keep that 3 o'clock Date
with your Kitchen
Have you a 3 o'clock date with your kitchen almost every afternoon? Does it keep you from doing many things you'd like to do . . . hurry you home when you'd like to linger . . . take you indoors when outdoors is at its loveliest?
Then why not let your electric range keep that 3 o'clock date for you? With modern temperature and timing controls and this scientifically modern cooking method, there's no need for you to be home at 3 o'clock to do the purely mechanical things necessary to start dinner cooking.
You've dreamed, perhaps, of a perfect jewel of a maid who would do just such things for you. But even if you had such a maid, someone would spirit her away from you, or some lucky man would marry her, and you'd be right back where you started from. But not with an electric range. It is yours for life. It asks no wages, eats no food, requires no extra room, and doesn't take Thursday afternoons off.
If this sounds over-enthusiastic, see the modern electric ranges that your household appliance and electric equipment dealers are showing and be convinced. It will be quite the most delightful discovery you have ever made . . . an end, forever, to those 3 o'clock dates with your kitchen.
Cook Electrically
Clean . . . Quick . . . Save
Save Fuel, Food, Time. Keeps Kitchens Dainty. Automatically Accurate. Smart, Graceful Designs. Economical of Space. Easy to Operate. Easy to Own.
The Modern Method for Modern Matrons
Edison
SEE THESE MODERN ELECTRIC RANGES
AT YOUR FAVORITE DEALERS
The following dealers display, demonstrate and sell fast-cooking ELECTRIC RANGES, at terms to suit your convenience, in co-operation with the Southern California Edison Company, Ltd.
American Ave. Hardware Co., 437 American
Barker Bros., Broadway at Locust
Baty Electric Co., 128 West Fourth St.
Blomskog Electric Shop, 412 American
Horace W. Green & Sons Hdwe. Co., 548 Pine
Kuster-Weitzel Electric Co., 214 E. Broadway
Mills Electric & Radio Co., 228 Pine
Parmelee-Dohrmann Co., 520 Pine Ave.
Phillips Furniture Co., 630 Pine Ave.
Sears Roebuck and Co., 5th & American
The Wise Co., Broadway at Pine

**Type of power company co-operative advertising carrying dealers' names done in Long Beach**

ordination of effort can possibly be brought about through the Electragists' representative and the co-operation of manufacturers previously mentioned. Handling of prospects was improved late in January by having the power company turn them over to one of the dealers, who passes them out to participating dealers in rotation. This is a temporary expedient until some better system is worked out.

Another thing dealers had to contend with was a $10 increase in wiring charge as soon as they took over sales. A strict ordinance in Long Beach makes the average cost $45, but the power company had been absorbing $10 of this, so the price to the customer had to go up $10. One dealer said that the only solution to the wiring problem was for power companies to find some way of capitalizing this expense. Already an investigation into this possibility, as well as that of providing temporary wiring for renters, is under way in California.

Trade-in allowances was another factor. Dealers have set a maximum of $10, whereas it seems that the power company had a method of figuring allowances for old

stoves, which in some instances were considerably in excess of this figure. The practice of most utilities on the Pacific Coast in this respect is to allow 10 per cent of the cash price of the electric range as a trade-in on present cooking equipment.

### What will be the outcome?

This remains to be seen. Dealers are wholehearted and unstinting in their praise of the co-operative spirit of the Edison company; dealers are positive they can do the job and do it alone; they do not want the power company back in the business on any basis; the power company has acquiesced to the demands of the dealers and is willing to be shown; jobbers and distributors do not think dealers can do the selling job alone; they feel that the power company should be back in the business on a kilowatt compensation basis for salesmen, whereby salesmen receive so much per kilowatt (one company pays $2 per kilowatt) of connected load, irrespective of who makes the sale, but with a small percentage (probably 2 per cent) in favor of the salesman so that he does not enter into collusion with the dealer and shunt all business through his hands; manufacturers and distributors of water heaters and heavy-duty air heaters feel that they are out of the picture because these devices require sales specialists with some technical knowledge, and if the power company does not promote them they will not be sold; they, too, feel that the power company should be back in the business on the kilowatt compensation basis; likewise, the Electragists favor this method of power company co-operation and compensation.

In any event, it can be said of the Long Beach experiment that all animosity has been ironed out and all interested parties have gone into this test case with open minds and with the fullest spirit of co-operation. The industry will watch with the keenest interest the final outcome.

# Rural Electrification Progresses in Illinois

By RICHARD BOONSTRA
*Agricultural Engineer*
*Public Service Company of Northern Illinois, Chicago, Ill.*

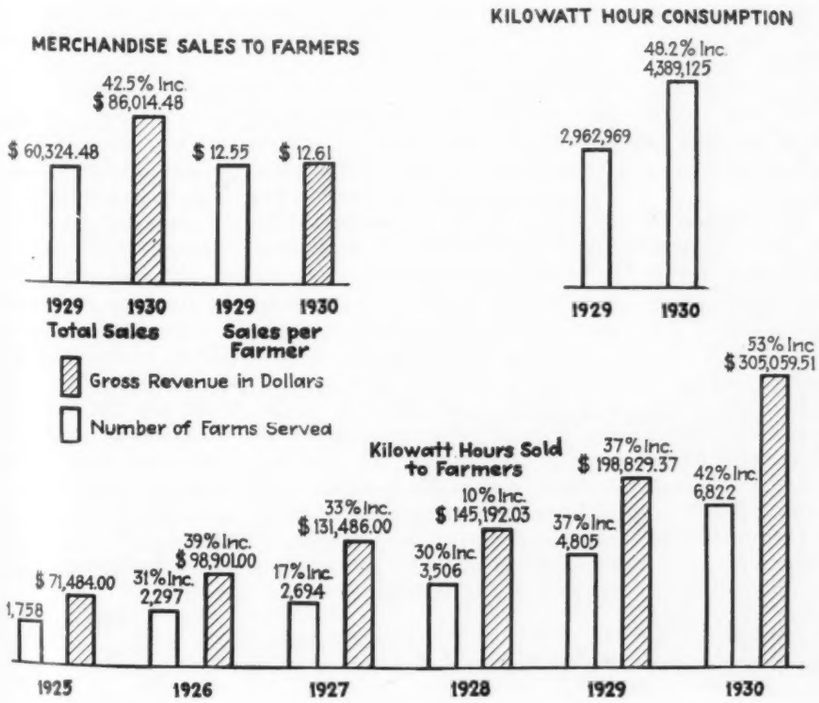
Progress in rural electrification made by the Public Service Company of Northern Illinois during 1930 indicates that much can be done even in a bad business year in extending lines to farm customers and in promoting the use of energy by those customers. To sell this class of service the company has put into the field men who are capable of working with the farmer on all of his problems, because worth-while applications of electricity must be based upon a sound knowledge of these problems. It is only by this means that electric service can be made an essential requirement of farm life, to bring those comforts and conveniences of electricity to those who produce so large a proportion of raw materials for human and animal needs.

### *Public Service of Northern Illinois Rural Load Growth in 1930*

| | |
|---|---|
| Total miles of farm line in service | 2,251 |
| Miles of farm line built during 1930 | 466 |
| Number of farms connected during 1929 | 1,299 |
| Number of farms connected during 1930 | 2,017 |
| Percentage of farms served to total number in territory, per cent | 28.8 |
| Yearly gross revenue estimated for new business signed during 1930 | $137,910 |

The accompanying chart shows that the buying of electrical equipment by the farmers on the lines of the Public Service Company of Northern Illinois has not diminished in 1930, but increased. Also the number of new farm customers has substantially increased. These increases were made possible by intelligent and extensive co-operation with the farmer through a rural service department whose personnel is adequate in training and in numbers to the job before it. Considerable progress has been made in the development of personnel through the medium of rural electrification short courses, such as those conducted by the University of Illinois, Purdue University and the University of Wisconsin.

It has been found that demonstrations of equipment on the farmers' premises, letting the farmers judge for themselves, was one the greatest aids in selling equipment. Such demonstrations in 1930 were confined entirely to feed grinding, silo filling, electric cooking and water pumping. Proper credit




**Public Service Company of Northern Illinois builds rural load**

is due to the manufacturers of these equipments for their hearty co-operation in furnishing machinery economical to operate. Feed grinders and silo fillers are two excellent examples.

▼

# READERS' FORUM

## Primary Network Involves Problems

*To the Editor of the* ELECTRICAL WORLD:

The three articles on "The Primary Network" which were published in the ELECTRICAL WORLD for March 14, 1931, indicate that considerable attention is being given to the problem of providing satisfactory systems for the distribution of electric service and the problem of reducing the cost of such systems. However, there is danger in attempting to draw general conclusions from the claims made in these articles, some of which are based purely on theoretical considerations and others on small installations with little or no actual operating experience.

It should be noted that all three of the cases described involve small areas where transmission circuits already existed and that practically no expense is included for transmission circuits. In such comparisons the investment in transmission circuits should be recognized as a part of the total investment if not of the immediate investment required. The comparisons in these cases were made with radial systems which obviously do not take advantage of some of the more recent ideas in distribution engineering.

Some of the claims made for the primary network scheme seem somewhat extravagant and others probably cannot be realized in many practical cases. It is very doubtful if locations for network substations can be secured in every case, or even in most cases, without any expense for real estate, at least in cities. The cost of substation buildings and equipment should not and need not be any higher for a properly designed radial substation than for the primary network scheme. The radial substation lends itself to standardization quite as readily as the primary network scheme and additions can be made in small increments in either case.

The application of the primary network scheme to larger territories involves a number of very difficult problems. In the ideal network scheme a different transmission circuit would be provided for each unit. Obviously, this cannot be realized in any ordinary case and it becomes necessary to connect two or more units to each transmission circuit. Two units connected to the same transmission circuit must not be adjacent nor even alternate to each other in the network, but must be separated in every direction by at least two units connected to different transmission circuits. It can readily be seen that when this idea is applied to a large area it results in an extensive and complicated system of transmission circuits and becomes very difficult and costly.

In addition to the difficulty involved in the transmission circuits, as described above, the problem of relaying an extensive primary network is rather difficult. The inverse time relays may operate satisfactorily on feeder faults if each unit has four feeders connected and all transformers are in service. However, with a transformer out of service there is danger of undesired operations, particularly if less than four feeders are connected to the unit whose transformer is out of service. This danger is still further increased by inequalities in the impedance of different feeders which cannot be avoided in practical cases.

While the voltage level in the network scheme may be more uniform than in a radial scheme with long feeders, it should be noted that in the primary network scheme it is practically impossible to apply load compensation without involving instability between regulators. Since the voltage drop in distribution transformers is a large part of the total voltage drop, this is a very serious objection. In a radial system load compensation can be provided to overcome the voltage drop in the distribution transformers as well as in the primary circuits.

It is easily possible in a properly designed radial system to keep the duty on oil circuit breakers as low as or even considerably lower than in the primary network scheme. In a large, recently designed radial system now in operation the maximum short-circuit current at the 4-kv. bus is 65,000 kva. This value will not be exceeded even with the ultimate development of the scheme.

In a properly designed radial system with short feeders there need be practically no greater losses than in the primary network system. The principal losses are in the branches, which are the same in either case. In such a radial system the area affected by an outage is no greater than in the primary network system.

About two years ago the Buffalo General Electric Company was faced with the problem of designing and building a distribution system covering a territory of about 65 square miles. The load was in excess of 100,000 kw. In this case it was necessary to provide transmission circuits to serve the new distribution system. The primary network scheme was very carefully and thoroughly studied at that time in comparison with several other schemes. These studies resulted in the adoption of a radial scheme having practically all of the advantages of the primary network scheme without its disadvantages. Comparative estimates indicated that this radial scheme would cost at least 10 per cent less than the primary network scheme for the same territory. A large part of this new system has been in actual successful operation for over a year and it is intended in the near future to publish a description of the system, together with some of the results of actual operation.

In making comparisons between different types of distribution systems, care should be used to recognize not only the immediate investment required but the total investment, including that represented by existing facilities which may be used in connection with the new scheme being considered. Care should also be used to avoid drawing conclusions from comparisons between such a scheme as the primary network with other schemes which do not take advantage of some of the ideas which are applicable to either scheme. In these articles many of the features claimed for the primary network scheme may be used to advantage quite as readily in a properly designed radial system.

**R. T. HENRY,**
Electrical Engineer in Charge of Design.
Buffalo, Niagara & Eastern Power Corporation,
Buffalo, N. Y.

# Men of the Industry

### *F. J. Gannon Removes to Tampa*

FRANCIS J. GANNON, formerly president of the El Paso Electric Company, El Paso, Tex., is now associated with the Tampa Electric Company, Tampa, Fla., and in his new position will assume the active management of a group of Stone & Webster properties in Florida. Before establishing an excellent record with the El Paso utility Mr. Gannon had a broad background of experience that fits him admirably for his

new duties. Beginning in the general offices of Stone and Webster, he has continued with that organization for 29 years. Florida is not new territory to Mr. Gannon, for it was from that state that he went to Texas in 1929. Before undertaking engineering work in Florida he had been connected with Stone & Webster companies in Dallas, Pawtucket, Brockton and Reno.

▼

EVERETT W. SWEEZY has resigned as president and general manager of Utilities Service Company, Suburban Light & Power Company and Suburban Power Company, operating in a score of Ohio cities. Mr. Sweezy has gone to Los Angeles to do research work in design of ice plants.

•

JAMES W. WELSH, assistant to President Joseph H. Alexander of the Cleveland Railway Company, has resigned in order to head his own organization as a consulting engineer with headquarters in New York and a branch office in Cleveland. Mr. Welsh severed his connection as executive secretary of the American Electric Railway Association in New York City to take the position with the Cleveland Railway September 1, 1929, shortly after the Van Sweringens, through Metropolitan Utilities, Inc., took control of the Cleveland property. Before entering the railway field he was employed as an electrical engineer by the National Tube Company, Wheeling, W. Va., and by the Westinghouse Electric & Manufacturing Company at East Pittsburgh. Mr. Welsh received his education at Wittenberg College, Harvard University and the Massachusetts Institute of Technology. He is a fellow of the American Institute of Electrical Engineers and for several years served as chairman of the Pittsburgh section of that organization.

▼

### *A. S. Durrant Retires*

ARNOLD S. DURRANT, for the past six years vice-president in charge of commercial relations of the International General Electric Company, Inc., retired from active service on March 1 and was made an honorary vice-president of the company following a connection of 40 years with the General Electric organization. A Briton by birth, Mr. Durrant came to this country in 1890 and soon entered the employ of the Edison United Electric Company. Company consolidations in the next few years produced the Edison General Electric Company and later the General Electric Company. In 1896 Mr. Durrant went to Schenectady. In 1898 he had charge of apparatus sales in the foreign department, and in 1908 he was made responsible for the handling of all Canadian business.

Upon formation of the International General Electric Company Mr. Durrant was made manager of the Department of the Americas. In 1925 he was elected vice-president in charge of all commercial relations of that company. He is on the board of each of the subsidiary companies in Argentina, Brazil, China, Colombia, Cuba, Mexico, Porto Rico and South Africa and is vice-president also of those in Colombia, Porto Rico and South Africa.

▼

THEODORE KRONSHAGE has been elected chairman of the Railroad Commission of Wisconsin. As announced in the February 21 issue of the ELECTRICAL WORLD, Mr. Kronshage is a prominent figure in the State of Wisconsin.

### *O. S. Peters Receives Prize*

ORVILLE S. PETERS, electrical engineer and inventor, of Chevy Chase, Md., has been made the recipient of the John Scott prize of $1,000 and the John Scott bronze medal for his invention of the electric telemeter. A native of Illinois, Mr. Peters obtained his technical education at Montana State College, and following the completion of his technical studies he joined the teaching staff of his alma

mater, spending one year as instructor in electrical engineering.

From 1910 to 1918 he was connected with the Bureau of Standards as assistant physicist. Since that time he has engaged in research work and special technical studies, this latest invention being the product of ten years of effort. The telemeter, a recording device for strains and pressures, has been in commercial use for a number of years and has a wide range of uses.

▼

JOHN DIBBLEE, general superintendent of the Niagara district, Ontario Hydro system, has been appointed to the recently established position of assistant operating engineer of the provincial system. Mr. Dibblee will be assistant to H. C. Don Carlos, operating engineer for the Hydro system. His successor as general superintendent of the Niagara system has not yet been named.

•

DONALD M. SIMMONS, chief consulting engineer of the General Cable Corporation, New York, was elected presi-

dent of the Insulated Power Cable Engineers' Association at the recent election of officers. The other officers elected were T. F. Peterson, cable engineer of the American Steel & Wire Company, vice-president, and Dr. R. J. Wiseman, chief engineer of the Okonite-Callender Company, secretary and treasurer.

▼

### *J. B. MacNeill Undertakes New Technical Duties*

TO SECURE CO-ORDINATION of effort, the Westinghouse Electric & Manufacturing Company has announced the appoint-

ment of J. B. MACNEILL as general manager of distribution engineering with headquarters at East Pittsburgh. This group comprises the engineering activities on switchboards, circuit breakers, meters, relays, high-tension insulators and lightning arresters.

Mr. MacNeill is a graduate of the Lowell Institute and Massachusetts Institute of Technology and has been continuously in the employ of the Westinghouse company since 1913. Prior to his present position of general manager of distribution engineering he held successively the positions of circuit breaker engineer, section leader on circuit breakers and manager of the circuit breaker engineering department.

The improvements in modern switching equipment covering high-speed circuit interruption at high voltages for purpose of system stability, the development of "Deion" circuit breakers, the apparatus for network operation of alternating-current distribution circuits, and isolated phase power-house equipment have been carried out under his direction.

Mr. MacNeill is a member of the American Institute of Electrical Engineers, the National Electric Light Association and the National Electrical Manufacturers' Association, and in addition to being active in committee work in these bodies has presented several contributions to the literature of circuit interruption. Mr. MacNeill spent the summer of 1930 reviewing European practice on switchgear and distribution apparatus subsequent to attending the World Power Conference at Berlin as a representative of the National Electrical Manufacturers' Association of the United States.

▼

### *C. A. Mayo Now in Salem*

CLARENCE A. MAYO, electrical engineer of the Malden (Mass.) Electric Company since 1923, has been appointed assistant manager of the Eastern Massachusetts Electric Company, with headquarters at Salem. Mr. Mayo is one of the best known engineers on the properties under the management of Charles H. Tenney & Company, Boston. His early career included service with the Oswego Gas & Electric Company, as superintendent. In 1915 he returned to Malden and was attached to the underground department of the company, later being appointed foreman of this and the meter department. Pioneer automatic substation installations were made in the northern Boston territory under his supervision. In his new post he will be active in the transmitting organization which interconnects the

Tenney properties centering at Salem and serving many north shore points. Mr. Mayo served two years as chairman of the engineering section of the New England division, N.E.L.A., and is a past-chairman of the Electric Lines Club of New England, besides being active in the American Institute of Electrical Engineers.

## OBITUARY

W. S. ROBERTSON, who became associated with the Combustion Engineering Corporation in 1912, died suddenly, March 31, at his home in Newark, N. J. Mr. Robertson was in his seventieth year and was actively engaged in sales work as special sales representative for northern New Jersey and eastern Pennsylvania until the time of his death.

•

CHRISTIAN BURKHARDT, pioneer business man of Burkhardt, Wis., and president of the Burkhardt Milling & Power Electric Company, died in that city March 21. Mr. Burkhardt was the founder of the Willow River Power Company in 1922. The company expanded and has completed hydro-electric properties at Willow Falls, Little Falls and the St. Croix plant, at Hudson, Wis.

•

P. L. HOADLEY of the Hoadley-Brookes Company, electrical manufacturers' agents, and for the past six years executive secretary of the Electric Club of Seattle, died at his home in that city March 27, following a brief illness. He was 71 years of age. Mr. Hoadley was formerly identified with the Westinghouse Electric & Manufacturing Company in Seattle, and at the time of his death represented Stanley & Patterson and I. M. Frink & Company.

•

CHARLES B. WATERS, electrical engineer and inventor and president of the Waters Arc Welding Company of New York, died suddenly, April 3, at his home in Montclair, N. J. Following graduation from Columbia University as an electrical engineer, Mr. Waters' first important undertaking was the completion of a power plant at Schaghticoke, N. Y. Later he was associated with the New York Central Railroad and was at one time electrical engineer of the Lehigh Valley Railroad. During the World War he was active in electrical and construction work on government plants. Mr. Waters invented an electric arc-welding device.

•

CHARLES S. BLAKE, chairman of the board of the Hartford Steam Boiler Inspection & Insurance Company, Hartford, Conn., died March 31 at his home in that city. Mr. Blake was considered an authority in the power machinery field. Equipped with a natural aptitude in things mechanical, he knew boilers and engines thoroughly from personal contact in their construction and operation. He became identified with the Hartford Steam Boiler Inspection & Insurance Company in 1898 and during a period of 33 years served as general agent, supervising general agent, second vice-president, secretary, president and in 1927 he was elected chairman of the board of directors.

# Financial and Statistical News

CONTINUATION of orderly but persistent liquidation for about two weeks brings utility common stocks to new low levels, still, however, well above the year's lows. Such stocks as Electric Bond & Share, Standard Gas & Electric, North American, etc., usually favorites with traders, have suffered steady selling. Passing of dividends is absent, in contrast with the situation in the industrial field.

——THE ELECTRICAL WORLD INDEX of 37 operating and holding company stocks stands now at 68.4, against 65.7 at the beginning of the year.

——INDICATIVE OF BASIC MARKET STRENGTH is the fact that while the market value of stocks rose over seven billions in the first quarter, brokers' loans increased only $15,000,000. In the same period last year market values went up over ten billions and brokers' loans over a billion, suggesting that stocks are today in stronger hands.

▼ ▼ ▼

## Insull Interests Buy Stock in Canadian Utility

THE INSULL INTERESTS of Chicago have acquired a substantial block of stock of the Winnipeg Electric Company and at a meeting of shareholders of the company held April 6 Foster Hannaford, assistant to the president of the Middle West Utilities Company, and J. A. McPhail of Sault Ste. Marie, Ont., president of the Great Lakes Power Company, were elected to the board of directors of the Winnipeg utility. No details concerning the purchase were given out at the offices of the Middle West Utilities Company in Chicago.

▼

## National Electric Power Reports Increased Earnings

NET INCOME OF THE National Electric Power Company for the year 1930 amounted to $5,321,299 after all charges and reserves, equal, after preferred dividends, to $3.71 a share earned on 1,136,085 combined shares of class A and class B common stock. This compared with $4,732,686, equal, after preferred dividends, to $3.45 a share earned on the same number of common shares in 1929. Gross earnings of the system were 4.97 per cent higher at $66,951,965, as compared with $63,782,569 for 1929. Sales of electricity were 1,261,083,000 kw.-hr., an increase of 7.9 per cent.

Expenditures for new construction totaled $35,757,432 and the generating capacity of power plants was increased from 664,000 hp. in 1929 to 882,000 in 1930. Customers numbered 650,472 as of December 31, 1930, compared with 619,104 the year before. It is interesting to note that 8,262 farm customers were added to the company's lines, bringing the total to 52,904. Stockholders of all subsidiaries at the close of 1930 numbered 113,479. Total assets at the close of 1930 amounted to $490,375,500 and property account was $398,978,476, as compared with $441,396,873 and $360,517,550 respectively in 1929. Current assets were $20,008,046 and current liabilities $7,338,124.

## February Revenue Lower

REPORTS OF ELECTRIC light and power companies received by the ELECTRICAL WORLD indicate that the revenue and energy sales are continuing to run somewhat below last year's figures for corresponding months, with a gross revenue for the industry as a whole in February of $182,300,000, or 1.9 per cent less than in 1930, and energy sales down 4.2 per cent. This still leaves a margin of gain of 3 per cent compared with the income in 1929 and in terms of average daily makes it the second highest month in the history of the industry, exceeded only by February, 1930.

In this respect February is the peak month in each year, since payment for the preceding long month, when for climatic reasons the energy consumption is large, is concentrated into a smaller number of days.

The greatest deficiency again appears in the industrial Middle West, where for a considerable period the greatly reduced demand of important industries has affected energy sales more unfavorably than in other sections of the country. The Middle Atlantic States, which in January reported an advance over 1930, now show a slight decrease, as does also New England.

▼ ▼ ▼

# 16 Per Cent Gain in Net Revenue of United Gas Improvement

SHOWING an encouraging departure from the record of most branches of industry in 1930, United Gas Improvement Company earnings went up sharply over 1929 totals. Total income was $36,178,286, a 9 per cent gain.

Net income was $32,810,744, an increase over 1929 of $4,535,634, or 16 per cent. After payment of dividends on preferred stock, the amount applicable to United Gas Improvement common stock was $30,256,714, an increase of $2,614,599, or 9.5 per cent. This was $1.30 a share on common stock outstanding December 31, 1930, compared with $1.26 a share for 1929, after giving effect to a full year's dividend requirements on the preferred stock. Profit from sale of securities and other nonrecurring income, which for 1930 amounted to $132,483, is not included.

Earnings of United Gas Improvement and subsidiaries for 1930 applicable to common stock was $35,861,882, or $1.54 a share, compared with $1.46 a share in 1929 on a comparable basis, but including the company's share of amounts added to subsidiary companies' surplus accounts.

Taxes increased $640,575 and were equivalent to 7.5 per cent of operating revenue, compared with 7.1 per cent for 1929. Federal, state and local taxes of United Gas Improvement and subsidiaries for 1930 will amount to approximately $9,712,000.

### President states company policy

In connection with publication of the company's annual report, President John E. Zimmermann took occasion to set down the cardinal policies on which the company operates. They were stated thus:

1. Effective regulation. The interests of the public and the public utilities are always best served by effective state regulation, and any well-considered measures cal-

culated to strengthen the confidence of the public in the regulation of public utilities will receive our co-operation and support.

2. Rates should be constantly adjusted so as to yield only a fair and reasonable return on the value of the property devoted to the public use. This return should be sufficient at all times to attract new capital and to include a reward for efficient, enlightened and honest management. Economies resulting from efficient management and from mergers, consolidations and interconnections should be shared with the consumer in reduction of rates.

3. Publicity in the financial affairs of a public utility inspires confidence on the part of the stockholder and the public. Public utilities therefore should issue at frequent intervals full statements of their earnings in sufficient detail to give their stockholders a thorough understanding of the affairs of their companies.

4. Holding companies are essential to the expansion and development of public utilities and must not be used to exploit either the consumers or the operating company. Full and complete disclosure should be made of all agreements between the holding company and its subsidiaries covering services rendered by the holding company for financing, managing, purchasing and construction, to insure that they are fair to the consumer, the operating company and the holding company.

5. Government should confine itself to regulation of public utilities and not go into the public utility business. Government should not compete with any of its citizens in any field of business.

▼

## Pacific Gas & Electric Employees Increase

WITH RESPECT BOTH to the number employed and the total amount of wages Pacific Gas & Electric Company employment continues to exceed pre-depression levels. The total number of employees computed on full-time basis was 15,492 in January last as compared with 15,106 in January, 1930, an increase of 386. Total wages paid in January, 1931, amounted to $2,360,066 as compared with $2,335,889 in 1930, an increase of $24,177.

▼

## Output Off, Especially Hydro

ENERGY OUTPUT OF ALL public utility power plants in the United States in February was 7,140,173,000 kw.-hr., the United States Geological Survey reports —a decrease of 6 per cent compared with the same month in 1930. On the same basis of comparison, production of electricity in January showed a reduction of 8 per cent, the largest comparative decrease since 1921. In line with the usual seasonal change, the average daily output decreased about 0.5 per cent from January, amounting to 255,000,000 kw.-hr. The three industrial regions were below but nearer last year's level than in January in quantities of energy generated.

Of the total, 2,166,840,000 kw.-hr. was generated from water power and 4,973,333,000 kw.-hr. from fuel. The former was 19.9 per cent less than in February of the previous year, while the latter was slightly greater, both changes reflecting the effects of the mild, dry winter with its resultant deficiency in stream-flow. Compared with January, the average daily production of electricity by use of water power was up 2 per cent, which is about the normal seasonal change.

Electric traction and other plants contributing energy for public use are included in this summary, as well as central stations for light and power, but the latter produce nearly 95 per cent of the total output.

## Relative Cost Halved Since 1913

THE PRICE OF ELECTRICITY to that class of domestic consumers to whom the "cost of living" applies has declined by 18.5 per cent since pre-war days, states the Bureau of Labor Statistics of the U. S. Department of Labor in its recent bulletin on prices and the cost of living. On December 31, 1930, such electric service was the only item which showed a decrease from its cost in 1913, whereas the prices of all other major classes entering into the "cost of living" budget showed increases ranging from 37.2 per cent for food, to 88.3 for housefurnishing goods and to 108.1 per cent for miscellaneous items.

This figure for the relative cost of electricity is based upon the average price of 20 kw.-hr. per month for household use in the 32 major cities of the United States. The general living expenses covered by $1 in 1913 now demand $1.607, but the electrical energy then bought for $1 now costs only 81.5 cents, if use is restricted to the same 20 kw.-hr. monthly. Relatively, then, the cost of electricity has been cut in half. With larger use the showing is even more favorable.

The ratio of decrease of electric service shown by the Bureau of Labor Statistics must not be confused with the 30 per cent decrease since 1913 in the cost of all domestic service, since the latter reflects, in addition to actual rate reductions, the decline in price which has accompanied the increase in the average use by all domestic consumers from 22 kw.-hr. per month in 1913 to more than 45 at the present time. The accompanying table shows the increase in each item of expenditure in the United States from 1913 to December,

### *Changes in Cost of Living in the United States, 1913, to December, 1930*

(Compiled from the Cost of Living Bulletin of the Bureau of Labor Statistics, United States Department of Labor, December, 1930.)

| | Per Cent of Increase Over 1913 in Expenditure for | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Food | Clothing | Rent | Fuel and Light | House-Furnishing Goods | Miscellaneous | All Items | *Decrease Electricity |
| December, 1914 | 5.0 | 1.0 | No change | 1.0 | 4.0 | 3.0 | 3.0 | 3.7 |
| December, 1915 | 5.0 | 4.7 | 1.5 | 1.0 | 10.6 | 7.4 | 5.1 | 6.2 |
| December, 1916 | 26.0 | 20.0 | 2.3 | 8.4 | 27.8 | 13.3 | 18.3 | 8.6 |
| December, 1917 | 57.0 | 49.1 | 0.1 | 24.1 | 50.6 | 40.5 | 42.4 | 11.1 |
| December, 1918 | 87.0 | 105.3 | 9.2 | 47.9 | 113.6 | 65.8 | 74.4 | 6.2 |
| December, 1919 | 97.0 | 168.7 | 25.3 | 56.8 | 163.5 | 90.2 | 99.3 | 7.4 |
| December, 1920 | 78.0 | 158.5 | 51.1 | 94.9 | 185.4 | 108.2 | 100.4 | 4.9 |
| December, 1921 | 49.9 | 84.4 | 61.4 | 81.1 | 118.0 | 106.8 | 74.3 | 4.9 |
| December, 1922 | 46.6 | 71.5 | 61.9 | 86.4 | 108.2 | 100.5 | 69.5 | 7.4 |
| December, 1923 | 50.3 | 76.3 | 66.5 | 84.0 | 122.4 | 101.7 | 73.2 | 8.6 |
| December, 1924 | 51.5 | 71.3 | 68.2 | 80.5 | 116.0 | 101.7 | 72.5 | 8.6 |
| December, 1925 | 65.5 | 69.4 | 67.1 | 86.9 | 114.3 | 103.5 | 77.9 | 9.9 |
| December, 1926 | 61.8 | 66.7 | 64.2 | 88.3 | 107.7 | 103.9 | 75.6 | 11.1 |
| December, 1927 | 55.9 | 62.9 | 60.2 | 83.2 | 104.6 | 105.1 | 72.0 | 12.3 |
| December, 1928 | 55.8 | 61.9 | 55.9 | 81.3 | 99.7 | 107.1 | 71.3 | 14.8 |
| December, 1929 | 58.0 | 60.5 | 51.9 | 78.7 | 97.7 | 107.9 | 71.4 | 17.3 |
| December, 1930 | 37.2 | 53.0 | 46.5 | 75.0 | 88.3 | 108.1 | 60.7 | 18.5 |

*The last column shows the per cent of decrease in the price of electricity on the dates specified as compared with the price in December, 1913. These figures are based on the average prices for 20 kw.-hr. consumed per month for household use in 32 cities and are included in the column "Fuel and Light" in this table.

1930. These figures are a summarization of the figures for the 32 cities, computed on a 1913 base.

▼

## Plan Reorganization of Atlantic Public Utilities, Inc.

PRELIMINARY PLANS for the reorganization of Atlantic Public Utilities, Inc., and subsidiary companies have recently been made under the approval of the protective committees representing securities of subsidiary and affiliated companies. It is proposed to form two new corporations, termed respectively the First Holding Company and the Parent Holding Company. The former is to acquire all the operating companies now comprising the Atlantic Public Utilities system with minor exceptions.

To carry out the provisions of the plan the $4,500,000 first lien and collateral trust 5½ per cent bonds (series A) of the First Holding Company are to be sold for cash and $2,615,000 is to be realized from the sale of common stock of the Parent Holding Company. Negotiations are understood to be under way with the Insull interests looking to the acquisition of control of the system. The reorganization committee comprises Gerald W. Peck of Emery, Peck & Rockwood Company, Chicago; James T. Woodward of Spencer Trask & Company, New York; A. S. Cummins of H. M. Byllesby & Company, Chicago; A. E. Fitkin of A. E. Fitkin and Company, New York, and E. L. McBride of A. B. Leach & Company, New York.

▼

## NEWS BRIEFS

Directors of the Pacific Lighting Corporation have adopted a resolution changing the record date of dividend payments on the common stock to the 20th day of January, April, July and October from the last day of these months. No change was made in the payment of dividends on the preferred stocks.

•

At the recent annual meeting stockholders of Stone & Webster, Inc., of Boston, approved the transfer of 70,000 shares of preferred and 90,000 shares of common stock of the Stone & Webster Engineering Corporation of Massachusetts to the Stone & Webster Engineering Company of Delaware in exchange for 95,000 shares of capital stock of the latter. This is merely an internal readjustment of Stone & Webster interests. The new Delaware company is owned by Stone & Webster, Inc.

## One-Hundred-Million-Dollar Utility Loan Floated

NEW FINANCING BY THE Pennsylvania Power & Light Company was the feature of the market this week, the transaction involving a total of $100,000,000. This public offering was in the form of first mortgage gold bonds, 4½ per cent series due 1981, priced at 96½ and accrued interest, to yield over 4.68 per cent. The bonds form part of an issue of $120,000,000 recently authorized by the directors of the company. The balance of $20,000,000 will be held by the Lehigh Power Securities Corporation, which controls Pennsylvania Power & Light. The proceeds of the present financing will be used to provide for the retirement of all existing mortgage debt of the company and the payment of other indebtedness heretofore incurred in connection with the acquisition and construction of property. All of the existing mortgage issues (except $500,000 non-callable bonds secured on certain minor parts of the property) are to be retired by redemption, and simultaneously with the receipt of the proceeds of these bonds, sufficient funds will be deposited in trust to provide for such redemption and for the payment of interest to maturity on, and the principal of, the $500,000 non-callable bonds.

During the past week the Public Service Company of Northern Illinois issued first lien and refunding mortgage 4½ per cent gold bonds, series F, to the amount of $40,000,000, the price being 97½ and interest, yielding about 4⅝ per cent. These bonds mature April 1, 1981. The proceeds from the sale of these bonds, together with funds provided from other sources, will be used to retire $37,250,000 bonds and debentures bearing higher coupon rates, and for other corporate purposes.

▼ ▼ ▼

# F. L. Dame Encouraged by Stimulating Signs

IN HIS regular quarterly announcement of electric output of North American subsidiaries, this week, Frank L. Dame, president of the North American Company, said: "Electric output of the North American Company's subsidiaries for the twelve months ended March 31, 1931, was within 1 per cent of the output for the twelve months ended March 31, 1930, and was 6½ per cent more than the output for the twelve months ended March 31, 1929.

"It is encouraging to note that total kilowatt-hours for the first quarter of this year were only 3¼ per cent under the output for the corresponding quarter during the record year of 1929, reflecting in a measure some recent gains made in business activity. The brief revival upward early last year which exceeded 1929 renders comparison with 1930 less favorable, the first quarter output this year being 4¾ per cent below the first quarter output in 1930.

"Numerous recently published surveys of general business have ignored boom conditions, with the result that they have been mere statistical post-mortems and therefore misleading. Too many of the depressing and backward-looking surveys take no account of the brighter aspects of business, and many signs of improvement are being missed. In the electric output of the North American System, for example, there is a noticeable absence of a seasonal dip normally to be expected as the daylight periods become longer. Actually, there is a horizontal trend which is decidedly encouraging, as indicating a gradual pick-up in industrial use of electricity supplementing the increase in residential and commercial use which continued through a year of depression and was a satisfactory offset to decreased industrial use.

### Dividend policy unchanged

"Many observers have been busy making comparisons of business trends without due regard for important present-day signs. Often these comparisons have led to various predictions and to the revival of worn-out rumors, such as the recent recurrence of the erroneous report of a change in the North American Company's common-stock dividend policy.

"In replying to inquiries from a few stockholders, who heard the rumor based on an opinion expressed by a misinformed investment advisory service, I have again said that no change in the policy is contemplated. In denying false rumors and in pointing to stimulating signs, I have made no predictions of a sudden rush of business or of large first quarter earnings as compared only with the first quarter of 1930. But I feel that confidence can be reposed in the favorable indications which have been reported by numerous electric light and power companies, such as the large amount of new connected load for industrial use referred to in the recently issued 1930 annual report of the North American Company."

# Business News and Markets

## Concerted Export Action Urged as Recovery Stimulus

"CONCERTED action is needed to bring about a revival of our export trade," declared Frank R. Eldridge, executive vice-president of the American Manufacturers' Export Association. "We have been through a world depression and the return to normal must also be worldwide. The impetus of a determined movement such as can be started by 900 of the leading American manufacturers engaged in export trade may well prove the beginning of such a world trade revival. We have enormous purchasing power in this country. We consume most of the world's rubber, affecting the prosperity of a wide group of prospective purchasers of our products in the Far East. We are the chief market for Japanese raw silk, for Brazilian and Colombian coffee, for Chile nitrate, for Bolivian tin, for Cuban sugar and many other products. In fact, our purchases of the world's raw materials account for nearly a third of the world's exportable surpluses. As we have only 7 per cent of the population we exercise a dominant influence per capita upon world demand.

"Our manufacturers, who are seeking to expand their foreign markets, are at the same time, in many instances, the greatest buyers of their potential customers' raw products.

"What is needed now is a concerted movement to sell our goods abroad. This should naturally follow the plans to distribute through long-time loans the world's supply of capital now congested and idle in New York and Paris. With capital available for productive enterprises in the principal markets of the world, the demands for our equipment and supplies will multiply. The American Manufacturers' Export Association is meeting these new world demands for our products by acquainting foreign buyers with the products of its members and bringing buyer and seller together."

▼

### Fairbanks, Morse Net Sales Lower

NET SALES OF Fairbanks, Morse & Company and subsidiaries for the year ended December 31, 1930, were $24,126,048, against $31,504,908 for 1929, a decline of 23.4 per cent. Gross income before depreciation, etc., was $2,004,908, against $3,991,685. Total assets of the company, excluding those of Municipal Acceptance Corporation, were $30,995,-219, against $40,799,964 at end of 1929.

▼

### Western Electric Sales Second Largest on Record

SALES MADE BY THE Western Electric Company during 1930 amounted to $361,478,000, against $410,950,000 in 1929, a drop of 12.3 per cent. At the same time the year's business exceeded that of 1928, the previous high record, by 25.5 per cent. While the company entered the year with the largest volume of unfilled orders in its history the recession in general business early in the year affected telephone equipment requirements and this business fell off sharply.

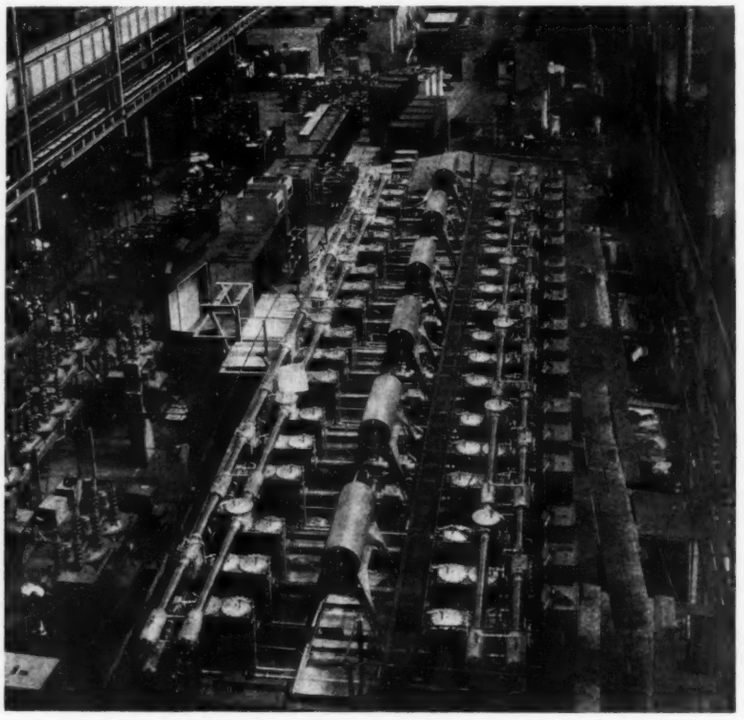
▼

### Weston Electrical Profits Reduced in 1930

PROFITS OF THE Weston Electrical Instrument Company for the year ended December 31, 1930, amounted to $733,-887 after depreciation, against $1,216,-432 for the previous year, a decline of approximately 40 per cent. Net profits after depreciation, federal taxes, etc., amounted to $615,075, against $970,041 for 1929, a drop of 36.6 per cent.

▼ ▼ ▼

### OUTDOOR METAL-CLAD SWITCHGEAR FOR JOLIET



*These 37-kv., 1,000,000-kva. oil circuit breakers have been ordered by the Public Service Company of Northern Illinois for the Joliet substation. The above view was taken in the oil circuit-breaker assembly section of the East Pittsburgh Works of the Westinghouse Electric & Manufacturing Company.*

# Symptoms of Convalescence*

THERE are certain factors entering into the explanation of the depression in this country and the possible acceleration of recovery which distinguish the 1930-31 decline from its predecessors. In the first place, we have now a vastly increased multitude of productive activities, and industry has become immensely more complicated than it was ten years ago and, of course, vastly more so than in 1907 or 1892. Furthermore, with the widespread development of mass production methods, there has been a piling up of overhead expenditures on industries, which has, of course, stimulated intensified efforts to pay interest charges. This has in many instances brought about the overproduction mentioned above.

In carrying further our comparison of the present depression with its immediate predecessors, one point of similarity which stands forth is the evident lag of the psychology of the cycle in contrast with the actual statistical trend of business. In every one of the major depressions of which we have accurate records it is evident that pessimistic feeling was at its worst at the very time when business had already begun to recover. This is understandable because of the obvious retarded accumulation of accurate statistics, which was, of course, even more aggravated in the earlier depressions than at present.

The comparisons with the curves of previous depressions tempt one to make some rough guesses as to the possible trend of recovery in the present instance. Figures now indicate that we are some 34 per cent below the normal trend and 41 per cent below the 1929 peak. Based on the comparisons of all depressions during the past 50 years, this ought by every calculation to bring us now to the bottom of the slump along which, judging once more from the records of all previous crises, we should continue for some three or four months, after which very gradual recovery should set in. Once again, on the basis of all of these previous recoveries, the average would seem to indicate that business volume will return to normal by about the middle of 1932. And about a year thereafter, if previous experience is repeated, it seems possible that another minor peak in business activity will be reached.

The descent into the depression was this time much more gradual than ever before, probably because of these controlling factors which have served as brakes on the machine. In previous instances business has stepped off the precipice for almost perpendicular descents, with inevitably disastrous results of almost catastrophic severity and abruptness. The confusion and hardship have, therefore, this time been relatively much less evident, even though the drop below normal has been greater (34 per cent) than in any of the previous depressions during this post Civil War period. There is, however, no definite relationship that can be discovered between the severity of the decline from the boom and the duration or rapidity of the return to normal levels. As a rule, it seems the decline was usually more precipitate than the recovery.

Probably the most conspicuous feature of the present situation has been the problem of industrial unemployment, though, of course, other factors, notably the agricultural aspects, have been almost equally prominent. Almost the first proposal actively discussed immediately after the October, 1929, crash was the question of wage maintenance. In the 1921 depression 92 per cent of the firms reporting to the Department of Labor announced cuts in wages. This time, however, only about 8 per cent of such firms have cut pay rates.

Here is another figure indicating the good faith of industrialists in carrying out their intentions in this regard as compared with the previous situation: In 1921 the production of manufactures fell 28 per cent below the previous year and the number of wage earners declined in almost exactly the same ratio. But in 1930, although production again fell just about 28 per cent, employment declined only 19 per cent.

*From an address by a leading economist before members of the McGraw-Hill staff.*

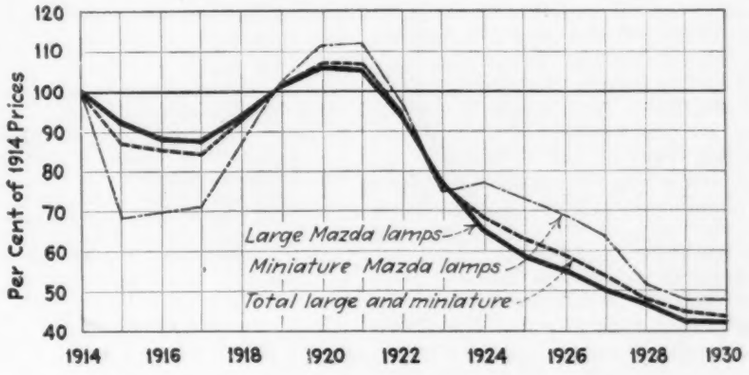
▼

## Lamps at 43 per Cent of 1914 Price

Lamp prices continue falling and at the end of 1930 were at a level of 43 per cent compared with the price in 1914 taken as 100 per cent. While this statement refers to average list prices of large lamps, miniature lamp prices have decreased almost as much.

The data on which the accompanying chart is based were compiled by the Incandescent Lamp Department of the General Electric Company, which adds an explanation that may be summarized as follows:

The compilation is based on the principal types of lamps sold in 1914; as new lamps are introduced to take the place of those that have become obsolete the quantities of the new types are extended at the prevailing list prices and then at the 1914 list prices of the types corresponding in 1914. Special lamps and new lamps of small demand have been excluded.




**Trend of average list prices on domestic "Mazda" lamps**

▼

## Little Copper Sold Under 10 Cents

THE LARGE COPPER-PRODUCING GROUPS have maintained their nominal quotation of 10 cents for Connecticut deliveries all week, although sales are recorded at 9½ cents delivered, with supplies scanty at that level. No domestic sales, however, have been reported at 10 cents, and the foreign business has been but little better. The expectation is that foreign buyers will need to buy something like 20,000 long tons this month, at least, but at present they feel that the export price should be reduced, so remain out of the market so far as possible.

| | April 1, 1931 Cents per Pound | April 8, 1931 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 9¼ | 9¾ |
| Lead, Am. S. & R. price | 4¼ | 4¼ |
| Antimony | 7 | 7 |
| Nickel, ingot | 35 | 35 |
| Zinc, spots | 4.30 | 4¼ |
| Tin, Straits | 2 ⅛ | 25½ |
| Aluminum, 99 per cent. | 23.30 | 23.30 |

Custom smelters intent on selling their intake this last week found little interest in offerings above 9½ cents.

# Market Conditions

BY FAR the best week this year in the equipment field is reported by the Eastern district. Central-station orders have reached an unusually large total and inquiries continue to foreshadow increasing volume. Railroad electrification needs and industrial demand also show expanding tendencies.

——MIDDLE WEST AND PACIFIC COAST ORDERS SHOW SOME BETTERMENT this week, but not to so marked a degree as Eastern business. Power company business still leads on the Pacific and wiring equipment orders are substantial.

▼ ▼ ▼

## PACIFIC COAST

—THERE HAS BEEN *an increasing number of sizable orders for wiring supplies, mainly for jobs awarded several months ago. All staples are moving better.*

—WIRE BUSINESS INCLUDES *street-lighting cable for San Francisco and various scattered jobs and a $25,000 order for General Electric cable for a cruiser now building at Mare Island.*

Power company business includes a $10,000 switchboard for San Francisco area and a carload of No. 0 bare copper wire for Los Angeles. As the rainfall has been light throughout the state, with little snow on the Sierra slopes, and as increasing pumping motor sales are indicative of actual need triumphing over public disinclination to buy, transformer sales are expected to show the usual seasonal improvement. Industrial business includes four mine locomotives valued at $18,000 reported by the San Francisco Westinghouse office for Wyoming installation, many small but widely distributed addition and reconditioning contracts for canning and packing plants, live stock and poultry buildings for Concord and Sacramento requiring several hundred reflectors each, and the announcement that General Motors proposes to erect this fall a 70-acre $10,000,000 plant near Los Angeles. Government business includes the San Francisco purchase of 200 electric ranges and 200 water heaters for the Canal Zone, the construction of a naval ammunition depot of 131 buildings in the Hawaiian group for which a telephone and distribution system is now being bid, purchases of wire, insulators and line hardware, a $400,000 award for constructing Air Corps barracks near Honolulu, and 30 beacons for the San Diego to El Paso airway. The $600,000 township to house the 6,000 workers and their families near the Hoover Dam site is soon to be sub-contracted for.

A very small gain in lumber output by Northwest Lumber Mills was reported last week, with operations 42 per cent of capacity, new orders 16 per cent over production and shipments 14 per cent over output. On account of the difficulty of financing new construction, the volume of building is substantially below that experienced in former years at this season and indications for spring and summer activity are far from promising. A fair volume of motor sales is reported, but apparatus and wire business is negligible, with nothing of consequence announced in prospect. Sales reported include one 115-kv. oil circuit breaker for the Rock Island plant of Puget Sound Power & Light Company, costing about $17,000; $2,000 worth of miscellaneous switchgear to central stations in Seattle and Tacoma, 70 motors from 150 hp. down to pulp and paper plants, lumber mills and miscellaneous sources, sixteen machines from 20 hp. down to woodworking plants and dealers and ten machines from 20 hp. down to an Alaskan fish cannery. City of Seattle bought ten 7½-kw. and ten 10-kw. pole type "A" Westinghouse transformers, four oil switch terminals and 125,000 ft. of guy wire and is taking bids until April 17 for 34 automatic induction voltage regulators estimated to cost $60,000. Board of Contracts and Awards, Tacoma, is taking bids until April 13 for installation, complete with appurtenances, of heat insulation for municipal steam plant No. 2.

### CONSTRUCTION PROJECTS

San Joaquin Light & Power Company, Fresno, Calif., plans transmission line from Gustine to Quinto Creek, to cost $30,000. San Diego Consolidated Gas & Electric Company, San Diego, Calif., plans extensions and improvements in power plants and transmission lines to cost $1,300,000, including equipment. Pacific Gas & Electric Company, San Francisco, Calif, plans power substation at San Jose, Calif. Grand Junction, Colo., is arranging bond issue of $750,000 for a city-owned light and power plant. El Oro Mining & Milling Company, Sells, Ariz., contemplates milling plant to cost over $100,000.

## SOUTHEAST

—ACTIVITIES IN THE *electrical field of the Southeast looked up slightly last week, both in central station and industrial lines, and while central-station purchases are primarily routine, the volume is increasing somewhat.*

One power company's distribution transformer orders last week aggregated $5,400, while its arrester orders totaled $4,800. Some other central-station orders were for $6,750 worth of insulators, $4,150 worth of meters, $3,775 worth of range switches and $3,400 worth of disconnect switches, the range switches being required on account of range sales campaign of one of the larger companies. A Georgia cotton mill ordered $25,000 in motors and $12,000 worth of wiring materials for an electrification project and another textile in the same state ordered three 1,250-kva. transformers. Contract was let last week for a $17,000 athletic field lighting installation job in Atlanta.

### CONSTRUCTION PROJECTS

Virginia Electric & Power Company, Richmond, Va., contemplates extensions and improvements in local ornamental lighting system. W. J. Heinz Company, Pittsburgh, has plans for an addition to food canning plant at Winchester, Va.

❖

## NEW ENGLAND

—DURING THE PAST WEEK *orders for electrical equipment were confined principally to industrial equipment, including small motors and control equipment. Sales of small motors have slowed down, according to one prominent manufacturer, though recently orders amounting to about $30,000 were received in this district.*

Switch and control purchases have been spotty. According to one manufacturer there is less activity than a month ago. Inquiries are fewer and interest is reported to be directed toward minimum requirements in equipment. Interest in heating furnaces is spotty. Recently one prominent manufacturer received orders for two of the small metal-treating type. Large furnace interest is less active. Central-station materials are receiving little notice at present according to one prominent distributor. Orders for materials for line extensions have been few in this district; it is expected that inquiries will be received for a number of fairly large orders for line materials; probabilities for expansion of substations in this district on a large scale are limited, though further expansion for power distribution

in one prominent southern Connecticut city is announced. New building construction will be limited in this district during the coming year, in the main, to institutional types.

**CONSTRUCTION PROJECTS**

Cumberland County Power & Light Company, Portland, Me., contemplates hydro-electric power development on Saco River to cost over $450,000, including transmission line. Littleton Hospital, Littleton, N. H., has completed plans for a power house. Reading, Mass., contemplates addition to municipal electric light and power plant to cost over $50,000.

❖

# MIDDLE WEST

—NOT MUCH CHANGE *in general business is observed this week in the Middle West section. General conditions seem to be improving, although the improvement is so gradual as to be hardly noticeable. Industrial activity is still quite spotty, but some improvement is observed in most lines of industry.*

Major activities indicate an improvement and the outlook for the coming quarter seems more promising. The various utility companies are proceeding normally with their spring construction programs. There has been a better demand for apparatus, while the demand for distribution equipment is holding up fairly well. Some of the interesting orders placed this week include 77,000 ft. of 750,000-circ.mil and 17,000 ft. of 1,000,000 - circ.mil single - conductor, 69-kv., paper-insulated, oil-filled, lead-covered cable, one 5,000-amp., 625-volt nominal rated rectifier unit complete with appurtenances, six 667-kva., oil-insulated, self - cooled, single - phase, 4,000-volt transformers, thirty 600-amp., 15-kw., three-pole, single-throw, wheel-mounted, solenoid-operated oil circuit breakers and several construction jobs aggregating $50,000.

**CONSTRUCTION PROJECTS**

Osceola, Wis., is asking bids until April 24 for an ornamental lighting system. Ford Motor Company, Dearborn, Mich., contemplates assembling plant at Vancouver, B. C., to cost over $500,000. Consumers Power Company, Jackson, Mich., plans extensions and improvements in power plants and transmission lines at Kalamazoo, Mich., and vicinity to cost over $600,000. Indiana School for Feeble-Minded Youth, Fort Wayne, Ind., plans new power plant at institution to cost $195,000, for which appropriation has been granted. Ohio State University, Columbus, Ohio, is asking bids until April 21 for improvements in power plant, including a 4,000-kw. turbo-generator and surface condenser, with accessories. Martins Ferry, Ohio, is completing plans for addition to power plant to cost $85,000 and will take bids for equipment. Vermillion, S. D., plans power plant, using Diesel-engine generating unit, to cost about $55,000. Universal Crusher Company, Cedar Rapids, Iowa, has plans for an addition to plant.

# EASTERN

—CONTRACTS FOR ELECTRICAL *equipment have rebounded to full strength in the Eastern district and easily the best week in many months has been recorded with the turn of April. Orders for prime movers for central-station service total $2,500,000, while other power utility account aggregates close to the $2,000,000 mark. The long-anticipated time when sizable business might break seems on the way.*

—INQUIRIES CONTINUE *to advance at a satisfactory rate under a distinctly improved market tone. Central-station account is the immediate center of interest. Railroad electrification is again about to score some heavy commitments with continuation of the Pennsylvania Railroad program. Industrial demand is trending upward.*

An important award has been made by the Public Service Electric & Gas Company to the General Electric Company for a 20,000-kw. mercury-vapor boiler and turbo-generator unit, with a 75,000-kw. steam turbo-generator, costing about $2,000,000, for installation at its Kearny power plant. This will be the second mercury turbine unit to be built and the largest machine of its kind; in addition to the generating capacity noted, the equipment will be capable of providing sufficient steam to generate 35,000 kw. in a steam turbine unit; it will use pulverized coal. The 75,000-kw. steam turbo-generator will be the largest machine of its kind in New Jersey and will advance the capacity of the plant from 287,000 to 387,000 hp. The Public Service Company will also carry out an expansion program at its Burlington power plant, to include an 18,000-kw. steam turbo-generating unit, high-pressure boiler and accessories.

Westinghouse Electric & Manufacturing Company has secured an order from the Boston Elevated Railway Company for a 35,000-kw. turbo-generator with complete accessories, totaling about $500,000. Six Companies, Inc., San Francisco, Calif., contractor for the Hoover Dam in Arizona, has placed a contract with Ingersoll-Rand Company, New York, for air compressors, rock-drilling and auxiliary machinery required for the five-year project. Troy Engine & Machine Company, Troy, N. Y., has been awarded a contract by the United States Engineers, Memphis, Tenn., for an engine-generating set. A metropolitan power company has placed an order with a state manufacturer for transformers, condensers, switchgear and auxiliary equipment to an amount of $1,500,000, one of the largest awards of its kind in many months.

Work will proceed on the electrification of the Pennsylvania Railroad Company system from Manhattan Transfer to Trenton, N. J., in the immediate future; orders are being placed for steel poles, crossarms, power substation and other equipment; the company will also install additional signal power equipment and accessories from Manhattan Transfer to Sunnyside Yard, to cost $100,000. Ingersoll-Rand Company has secured a contract for seven oil-electric locomotives for switching service from the Bush Terminal Company, all electrical equipment to be furnished by the General Electric Company.

**CONSTRUCTION PROJECTS**

Signal Supply Officer, Signal Section, Army Base, Brooklyn, N. Y., is asking bids until April 17 for quantity of cable (Circular 410); also, until April 24 for quantity of telephone wire, guy anchors, line protectors, etc. (Circular 124). American Mineral Spirits Company, New York, plans expenditure of over $400,000 for proposed oil products plant at Carteret, N. J. New York Central Railroad Company, New York, has filed plans for a freight building and storage plant to cost $700,000. Barrett Company, Philadelphia, Pa., has plans for five additions to roofing and coal tar products plant to cost over $350,000. Pennsylvania Power & Light Company, Allentown, Pa., has purchased tract of 26 acres of land near Hummelstown, Pa., and contemplates large power substation. United States Engineer's Office, Wilmington, Del., is asking bids (no closing date stated) for reserve lighting plants for four bridges crossing Chesapeake and Delaware Canal. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until April 21 for an electric traveling crane (Panama Schedule 2645).

❖

# SOUTHWEST

—THE VOLUME OF SHIPMENTS *in stock sizes of motors and transformers remains quite constant and inquiries coming in indicate a healthy tone, with nothing spectacular.*

There have also been some good-sized consignments of pole-line material sent into the southwestern part of this district. The only orders worthy of mention reported are as follows: A 1,500-kva., three-phase transformer for a St. Louis factory costing $7,500 and a white-way job for a municipal plant in southwest Missouri.

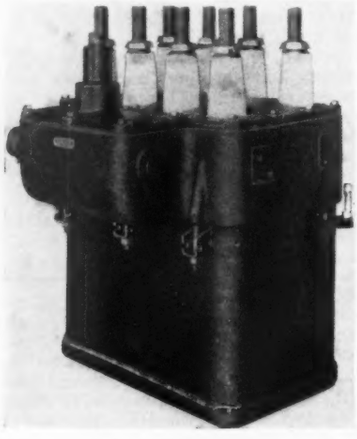
**CONSTRUCTION PROJECTS**

James R. Kearney Corporation, St. Louis, Mo., has filed plans for addition to electrical equipment manufacturing plant to cost over $75,000. Summe Dairy Company, Kansas City, Mo., plans plant to cost about $65,000. DeSoto, Mo., is arranging bond issue of $95,000 for installation of power distributing system. Southern Pacific Railroad Company, Dallas, Tex., will make extensions and improvements in locomotive shops at Ennis, Tex., to cost $60,000.

# New Equipment Available

## 2,500-Amp. Breaker at 15,000 Volts

AN INDOOR OIL CIRCUIT BREAKER with inclosed type mechanism and all poles in one tank, known as type DR-25, has been announced by the Condit Electrical Manufacturing Company, Boston, Mass. This breaker offers the features of non-oil throwing, greater clearances,



quick-clearing operation, small space requirements and provision for venting gases.

It is furnished three or four pole, manually or electrically operated for 600, 800 and 1,200 amp. at 15,000 volts. Estimated interrupting capacity 2,500 amp. at 15,000 volts.

▼

## Rheostat and Ohmite Resistance Unit

TWO NEW PRODUCTS, a rheostat and an ohmite semi-variable resistance unit, have been announced by the Ohmite Manufacturing Company, Chicago. The rheostat incorporates the use of a circular porcelain core on which the resistance wire is wound, the core forming a solid non-shrinking backing for the wire. This wound core is mounted on a base also of porcelain, and the entire unit, with the exception of the surface where the wiper arm makes contact, is covered with vitreous enamel which cements the whole unit together and serves both to protect the wire and to carry off the heat generated in the wire.

To bridge the gap between fixed resistance units and the new rheostats, a series of semi-variable units are announced. The units are of the standard vitreous enameled type, but they have the enamel bared on one side along their length so that contact may be made with the resistance wire by an adjustable clip.

▼

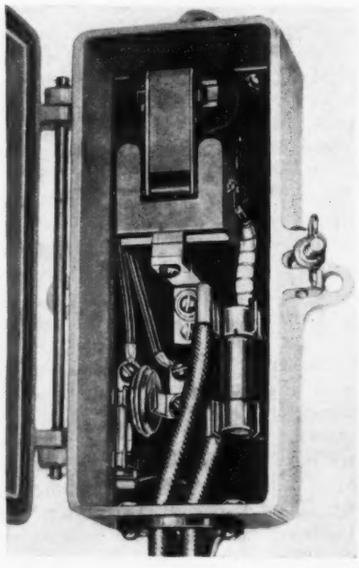
## Combination Range Cabinet

A COMBINATION RANGE CABINET with three-wire, 60-amp. meter test switch has been announced by Morgan J. Lewis, Philadelphia, Pa. The dead front branch circuit cabinet contains six circuits for lights (or the top two fuses may be used for water heater) and a 60-amp. range circuit, wired completely; meter leads, fuse pulls and meter board. The circuit conduits enter the top of the cabinet. No ells or bends are necessary.

▼

## Single-Pole Relays for Outside Lighting Circuits

A LINE OF RELAYS for use in operating exterior lighting circuits from a multiple control wire, known as "Gravitype," has been announced by the South Bend Current Controller Company. This line consists of relays of two sizes, 30 amp. and 60 amp. capacities at 125 volts, a.c. The relays are single pole and have



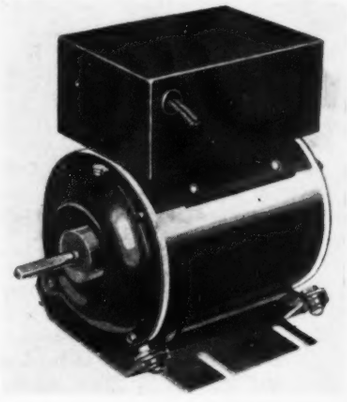
circuit-opening contacts, held open when the operating or holding coil is energized and held closed by gravity when the coil is de-energized. An important feature in the new line of "R-C-O-C Gravitype" relays is the exclusive use of non-welding contacts made from a new low-resistance alloy. Relays are available for operation from 25 or 30 and 50 or 60 cycle control circuits.

▼

## High-Starting Torque Constant-Speed Motors

A COMPLETE LINE OF fractional-horsepower motors from $\frac{1}{6}$ to $\frac{3}{4}$ hp. has been announced by the Howell Electric Motors Company, Howell, Mich. This line consists of condenser start, split-phase and polyphase motors, all built in a frame with the same mechanical dimensions.

The condenser motor has the condenser mounted in a compact, neat-



appearing box on top of the motor, with all connections made inside the box. The standard condenser box, though mounted on top of the motor, may be mounted either on the side of the motor or at any convenient place on the driven appliance, or on the wall. Provision is made on all boxes for wall mounting.

The condenser motors, known as the type CI, are high-starting torque, constant-speed motors, having at full voltage a starting torque of from 300 to 400 per cent of full-load torque and a maximum running torque of at least 200 per cent of full-load torque. Starting current on these motors is within N.E.L.A. limits and the running characteristics (efficiency and power factor) meet N.E.L.A. performance requirements.

▼

A LOW-BED, TWO-WHEEL TRAILER, to be used for transporting tile duct, fiber conduit, transformers, etc., has been announced by the Utility Supply Company, Clintonville, Wis.; also a lighter model, for transporting appliances such as electric stoves, refrigerators, etc., the thought being that a low-platform trailer would be safer and easier for the men to load, as it would cut down the hazard which is present when material is raised up in the air.